University of Brighton

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Proceedings of the

21st European Conference on e- Learning

ECEL 2022

Hosted by the University of Brighton

27-28 October 2022

Edited by
Dr Panagiotis Fotaris
Dr Andrew Blake

A Conference Organised by ACI, UK

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Review Process

Papers submitted to this conference have been double-blind peer reviewed before final acceptance to the conference. Initially, abstracts were reviewed for relevance and accessibility and successful authors were invited to submit full papers. Many thanks to the reviewers who helped ensure the quality of all the submissions.

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Contents

ECEL Preface

These proceedings represent the work of contributors to the 21st European Conference on e-Learning (ECEL 2022), hosted by ACI and the University of Brighton, UK on 27-28 October 2022. The Conference Chair is Dr Panagiotis Fotaris, and the Programme Chair Dr Andrew Blake, both from University of Brighton, UK.

ECEL is now a well-established event on the academic research calendar and now in its 19th year the key aim remains the opportunity for participants to share ideas and meet the people who hold them. The scope of papers will ensure an interesting two days. The subjects covered illustrate the wide range of topics that fall into this important and ever-growing area of research.

The opening keynote presentation is given by Liz Cable, Leeds Trinity University and the International Research Centre for Interactive Storytelling, who will present *Broken Games for Learning*. The second day of the conference will open with an address by Phil Ashford, Enterprise Exchange Ltd, Brighton, UK, on the topic of *"Developing Augmented and Virtual Reality in training adults from underrepresented groups".*

With an initial submission of 201 abstracts, after the double blind, peer review process there are 55 Academic research papers, 2 PhD research papers and 4 work-in-progress papers published in these Conference Proceedings. These papers represent research from Australia; Austria; Belgium; Bhutan; Canada; Chile; Cyprus; Czech Republic; Denmark; France; Germany; Greece; Hong Kong; India; Indiana; Ireland; Italy; Japan; Kazakhstan; Latvia; Malaysia; Nigeria; Norway; Romania; Saudi Arabia; Slovakia; South Africa; Sweden; Tanzania; The Netherlands; UK; USA; Vietnam; Zimbabwe.

We hope you enjoy the conference.

Dr Panagiotis Fotaris, and Dr Andrew Blake

University of Brighton, UK
October 2022

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Biographies

Conference and Programme Chairs

Dr Panagiotis Fotaris is Senior Lecturer and Course Leader for BSc Digital Games Development and BSc Computer Science for Games at the University of Brighton. He has previously held posts at the University of East London, University of West London, King's College London, and Abertay University. Before entering academia, he spent a decade in the Creative Industries in a variety of roles including mashup artist, radio producer, DJ, graphic designer, web developer, and music journalist. When not playing adventure games, Panagiotis focuses his research on the pedagogical potential of escape rooms, games, and immersive technology in the context of computing and design education.

Dr Andrew Blake is the Programme leader of the University of Brighton's MSc UXD. Primarily, this course equips students with the practical skills to work as effective UXD practitioners within the interactive / digital industries. Further, students are encouraged to critically reflect upon and question the effectiveness of contemporary thinking that underpins UXD best practice. His interest in e-learning focuses on the efficacy of information presented to learners. His current projects of interest include work with Jadavpur University, Kolkata, explore the cognitive implications of learners when presented with information, which considers learners being located on a spectrum. At one end of the spectrum there are textual / verbal learners and at the other end of the spectrum there are visual learners. As well as a project with colleagues at Cambridge University, he has recently concluded a project entitled 'Accessible Reasoning with Diagrams'; the project is funded by The Leverhulme Trust
https://sites.google.com/site/myardproject/.

Keynote Speakers

Phil Ashford is an experienced and accredited business adviser with a background in both the private and public sector, specialising in pre-start up business advice for people with additional barriers. Phil has delivered business planning workshops and one to one business start-up coaching for a range of people from disadvantaged backgrounds. He is the former director of the East Sussex Gateway, a Business Link service which provides pre start-up support for people with additional barriers. Phil has also taken part in the NEWCEP steering group and the City Skills and Employment Group in Brighton and Hove. He lectures at German universities on mentoring. Phil has a MBA, a Diploma in Performance Coaching, is a Prince 2 Practitioner and a SFEDI Accredited Business Adviser. He is a registered Growth Accelerator coach, PTTLS qualified and Enhanced DBS checked. Phil also volunteers as a mentor for the Brighton Business Community Partnership.

Liz Cable is a Senior Lecturer, School of Digital and Screen Media Leeds Trinity University and the International Research Centre for Interactive Storytelling. She is the course-leader for their single honours Media & Marketing Degree Programme, and teaches on all Media Courses, our Digital and Social Media Degree, and Leeds Trinity's new Creative and Professional Writing Degree.. Liz is a strategic social business consultant, helping clients articulate and deliver practical strategies for adopting and embedding technology in working and learning practices. She spends a lot of time creating and managing online communities, and my expertise is in engagement strategies to bring people together online to share, to work and to learn. Liz founded Reach Further, the UK's first social media consultancy in 2006, and has helped thousands of businesses understand and realise the potential of social media through workshops, seminars and consultancy.

Mini-Track Chairs

Prof. Dr. Abbas Fadhil Aljuboori is working currently at IT department, Al Zahra College for Women, Sultanate of Oman as a faculty Staff member. He has a Ph.D. in Computer Science from Dongguk University, South Korea. Fulbright Visiting scholar – University of Central Oklahoma, USA. International Advisory Board Member for CT University in India. His field of Interest are in Data Mining, Web Applications, Big Data, Data Security, Information Systems and Smart Applications. He is a member of several academic and professional societies. He is an Editor, Committee Member and Reviewer of many eminent International Journals and Conferences worldwide.

Dr Adrian A. Adascalitei is Professor at Technical "Gh. Asachi" University and at "Al. I. Cuza" University, Iasi, Romania. His specialist area is Blended STEM Teaching and Learning. He has authored and co-authored various papers in International and European conferences and journals. His research focuses on blended learning, use of virtual laboratories in STEM Education. In 2007 he authored a manual entitled "Computer-Aided Instruction. E-Pedagogy" (in Romanian: Instruire Asistată de Calculator. Pedagogie Informatică), Polirom Publishing House, Iasi, Romania.

Wilfried Admiraal is full professor of Education and Technology at the Centre for the Study of Professions of Oslo Metropolitan University in Norway. His research interest combines Educational Sciences, Social Psychology and technology, in secondary schools and higher education. He published journal articles on game-based learning, learning with web-based video, the use of annotation tools in collaborative writing and online communication and interaction.

Dr. Ayanda Pamella Deliwe holds a Ph.D. from the University of KwaZulu Natal. Her Ph.D. was on Measuring e-learning systems at higher education institutions. She is an academic at Nelson Mandela University. She has 10 years of experience working in the public sector and 5 years of experience in higher education. Dr. Deliwe has published several papers on e-learning in academic journals and conference

proceedings. She serves in the school research committee and faculty teaching and learning committee of her university. Her main research interests are e-learning and blended learning and new pedagogies.

Dr. Joanna Rosak-Szyrocka Erasmus+ coordinator at Faculty of Management Czestochowa University of Technology. She specialized in the fields of quality 4.0, education, distance learning, industry 4.0, quality management of sport, IoT issue. Reviewer for a number of prestigious Journals: e.g. Ieee Access. Vice President of Qualitas Foundation, dealing with the promotion of good business practices. She completed a research internship at the University of Żilina, Slovakia, as well as at Silesian University of Technology, Zabrze, Poland. Participant in multiple Erasmus+ teacher mobility: Italy, UK, Slovenia, Hungary, Czech Republic, Slovakia, France.

Nadira Saab is professor e-Didactics by special appointment at ICLON, Leiden University Graduate School of Teaching in the Netherlands. Her research focuses on e-didactics, technology enhanced education, inclusive education, collaborative learning, assessment and motivation. She studies these subjects as applied to children, adolescents and young adults.

Prof Shawren Singh (PhD), is an associate professor and chair of Department in the School of Computing at the University of South Africa. He has spent more than 20 years teaching and researching in the Information Systems space. His current research has focused on digital scholarship and e-Government.

Dr. Justyna Żywiołek was born on December 24, 1986 in Częstochowa. She completed her master's studies in the field of Metallurgy in 2010. In 2014, she defended her doctoral dissertation with honors in the field of management science, specializing in security science, at the Faculty of Organization and Management of the Lodz University of Technology. Since January 2015, he has been working as an assistant professor at the Faculty of Management at the Technical University of Częstochowa. She is a respected researcher in Poland and abroad for his experience in management issues: knowledge and information management and their security.

Author Biographies

Dina Adinda Ph.D. in Education and Training Sciences is currently a training manager at the University of Paris Nanterre affiliated with the CREF UR 1589. Her research interests include higher education, students' self-direction, and technology for teaching and learning.

Muriel Algayres is a PhD fellow in the Department of Architecture Design and Media Technology at Aalborg University Copenhagen, Denmark. She holds a M.A in Educational science, and her research interest resides in technology-enhanced learning, active learning and game-based learning.

Mustapha Almasi is a blended learning researcher at Mzumbe University in Tanzania. He has published various papers on blended learning in various international Journals.

René Holm Andersen is an Associate Professor at the University College of Northern Denmark's department of continuing education (act2learn) leadership and organisation. He focuses his research on using podcasts and podcasting as a learning media in higher education.

Greta Braun is a PhD student at Chalmers University of Technology, Sweden, researching about the Future of Work. She's passionate about sustainability in industry, and focuses on how it can be enabled by human empowerment and upskilling the workforce. Greta's background lies in engineering and in learning and leadership.

Svetlana Buko, sociologist,methodologist,cross-border researcher with intercultural experience from six countries. Worked for INGO; managed USA-Europe interdisciplinary teams for national qualitative/quantitative research in leadership, women entrepreneurship, & cultural intelligence. Docent of intercultural management, teaching for MA-Level Program "Intercultural Management" (Nova Gorica, Slovenia); Program Director of BA-Level Intercultural Management degree. Carinthia University of Applied Sciences (Villach, Austria). Currently working on research project "Entrepreneurship & intercultural competencies in tri-border region: Italy-Austria-Slovenia,"; serves as instructional designer for cross-border COIL business laboratories

Tim Cappelli has worked with educational technology for over 20 years, from setting up work-based learning centres to introducing blended learning initiatives to HE. He was responsible for the first large-scale deployment of iPads in HE, the development of a new learning platform in WordPress and the creation of a digital Curriculum Mapping Tool.

Parker Chan is a lecturer of Chinese at The Chinese University of Hong Kong and a doctoral candidate at the University of Oxford. His main research interests lie in history of Chinese classics, pre-Han and Han dynasty Chinese texts, excavated texts, and classical interpretations.

Felix Chao is Senior Lecturer at the Independent Learning Centre of the Chinese University of Hong Kong, the institution from which he received a PhD in Chinese language and literature. His academic and research interests include classical Chinese literature, Chinese grammar, Chinese communication skills, Chinese language education and independent learning.

Paula Charbonneau-Gowdy is a graduate of McGill University and professor of education at Universidad Andres Bello in Santiago, Chile. Formerly Senior Advisor in Learning and Technology for the Government of Canada, she also has work experience in Europe and Chile. Her main area of interest is the socio-cultural implications of emerging technologies on teaching, learning and learners at all levels of the educational system.

Elizabeth Childs Professor and Program Head of Learning and Technologies programs, School of Education and Technology, Royal Roads University, Canada. Interested in design, creation and implementation of flexible learning environments incorporating affordances of information and communication technology (ICT) and provide learners with increased choice, flexibility and opportunities for co-creation. Expertise in educational technology & instructional design, design

thinking, open education and online learning, research interests include open educational practices and pedagogies; creation of online communities and digital habitats; design thinking and models for immersive professional development.

Jonas Collin works as Media Pedagogue and Producer at the Department of Computer and Systems Sciences at Stockholm University where his studio is located. He also works for the University-wide Centre for the Advancement of University Teaching where he trains teachers in using media within higher education.

Liesbeth Coppens is a PhD researcher at the School of Educational Studies at Hasselt University (UHasselt). Her research focus includes supportive interventions in higher education to create equal learning outcomes between students.

Maria DENAMI is a Associate Professor in Education Sciences, and she works at the University of Upper Alsace (Mulhouse). Interested in Higher Education Pedagogy, her main research topic is the process of professionalization of students and their support in developing professional competencies. She is a member of the "Learning, Teaching and Education Practices" team at LISEC laboratory.

Ana Donevska-Todorova is a post-doctoral researcher at the University of Applied Sciences HTW Berlin, Germany. She received her PhD in mathematics education from the Humboldt-University of Berlin in 2017. She is a co-leader, a member of international program committees and an editor of books and conference proceedings at MEDA2018-2022, ICTMT2019, CERME2022 and ECEL2022.

Bianka Dörr is a project manager at the August-Wilhelm Scheer Institute, Germany where she works on sustainable digital learning concepts and solutions. She received her master's degree in adult- and continuing Education from the Otto-Friedrich-University of Bamberg. Her main research area at the Institute is learning in extended realities with focus on haptic learning.

Christos Douligeris, currently a professor at the Department of Informatics, University of Piraeus, Greece, held positions with the Department of Electrical and Computer Engineering at the University of Miami. He was an associate member of the Hellenic Authority for Information and Communication Assurance and Privacy and the President and CEO Hellenic Electronic Governance for Social Security SA.

Xiangping Du is a principal lecturer and Deputy Associate Dean Postgraduate Student Experience at Hertfordshire Business School, University of Hertfordshire, UK. She received her PhD in sociolinguistics and education in 2005. Her main research focuses on pedagogical research, learning and teaching in higher education, e.g. e-learning, blended learning, MOOCs, identity, diversity in classroom, cross-cultural communications and transnational higher educations.

Rachel Fitzgerald is the Director of Online Education in the Business School at the University of Queensland. Dr Fitzgerald is a leader in digital learning and learning innovation and is recognised internationally for developing contemporary curriculum for the digital age. Her research is focused on innovative approaches to future focused curriculum, student experience and digital learning.

Caroline Galdames is a Preschool Educator. In 2011, she received a Master's degree in Innovation in Early Childhood Education from the Universidad Central Chile. Since 2014, she has worked in Online Education as Academic Vice-Rector at a technical higher education institute in Chile. She is currently a PhD student in the Education and Society doctoral program at Universidad Andres Bello, Chile.

Michael Glass is a professor of computer science at Valparaiso University, IN, USA. He received his PhD in computer science from Illinois Institute of Technology in 1999. His main research area is dialogue-based computer-aided collaborative learning.

Thomas Goetz is a professor of English and Director of the Cross-Departmental Language Program. He has been a leader in Moodle at Hokusei University, promoting blended learning at all levels. His

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Investigating Learning Experience When Lecturer and Learners' Roles are Reversed

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Abstract: The "reversed classroom" involves the reversals of the learning instruction and the lecturer and student roles in class. The study investigates the learners' views of a reversed classroom on their first online learning experience, the development of the competencies targeted by the course, and how the reversed classroom promotes self-direction. On three occasions (at the beginning, middle, and end of the course), learners were required to complete a self-positioning survey and declare their perceptions of their competencies. They were also invited to point out their learning experience using a questionnaire. Data collected were analysed using the descriptive analysis method. Learners also shared their views on how the adopted reversed classroom ensured their self-directed learning in the interview. This data was analysed using thematic analysis. The findings revealed that although this was the learners' first experience of a reversed classroom, they appreciated it and developed various competencies. They further confirmed that the learning setting, the mentoring roles, and the pedagogical styles adopted successfully ensured their self-direction in learning.

Keywords: reversed classroom, flipped classroom, online learning, adult education, self-direction

1. Introduction

Blended and distance learning have become more common in almost every level of education: primary and secondary schools, university, and lifelong education. Various pedagogical approaches and techniques are applied to identify the best practices to promote effective learning. Rimini & Sipezia (2016) reported for the OECD that supporting learners' self-direction, in particular, remains a significant priority as it is one of the essential skills to enable learners to face professional challenges, notably in the digital world. As an advanced form of the flipped classroom, the reversed classroom targets learners' creativity and deep learning by reversing the lecturer and learner roles in the course (Cailliez, 2017). It also gives learners the freedom to take initiative, which implies the ability to identify learning objectives and needs essential in developing self-direction (Hadji, 2012). However, the learning environment of the reversed classroom is not the only dimension that can influence learners' behaviour in learning, as stated by Bandura (cited in Ponton & Carr, 2012). Consequently, it might be possible to expect a peculiar result for a particular audience experiencing an online reversed classroom for the first time. This study investigates the learner perceptions of the learning experience in an online reversed classroom and how it can promote self-direction and help them develop various competencies. To address the research problem, the participants answered a self-positioning survey on three occasions, filled out a questionnaire (the module's report), and participated in a semi-structured interview. With the help of both literature and the study's findings, the authors highlighted the importance of aligned goals between learners' learning progression and lecturers' mentoring roles and pedagogical style.

2. Literature review

2.1 Targeting learners' self-direction

Self-direction was introduced in France in the late 1980s in adult education (Carré et al., 2011). Knowles (1975, cited in Dynan, Cate, and Rhee, 2008) defines self-direction as the ability of an individual to conduct their own learning to promote lifelong learning. Hadji (2012) states that self-direction requires learners to take the initiative in their learning. Indeed, learners should develop the abilities to determine their learning goals and strategies and to identify resources to achieve and evaluate them (Carré, 2010). Hence, self-direction can occur when learners are able to recognise an interest in given goals. It can also emerge when they discover their value and can implement self-determined actions. Consequently, Cosnefroy & Carré (2014) state that self-direction is within the high level of self-regulation, confirming that self-direction has two main dimensions with self-efficacy as a common element related to both:

- Self-determination (The individual has the freedom to act, is proactive, and able to incorporate given goals or to identify their own)
- Self-regulation (The individual can identify a goal and an appropriate strategy to achieve it, to regulate their actions and strategy, and to persist in a task)

Self-direction is a phenomenon taking place in a social context which influences and is influenced, among others, by the learning environment (Hiemstra, 2015). The learning environment consists of various elements including training materials, resources, pedagogical approaches implemented by lecturers, mentoring strategies, etc. (Carré, Jézégou, Kaplan, Cyrot, and Denoyel, 2011). Jézégou (2008) has put forward the potential of self-direction among learners by assuring the openness of the learning environment, particularly in distance learning. However, according to Carré (2003), it is noteworthy that the idea of freedom offered in the learning environment does not automatically promote the development of the students' self-direction. Learners may not perform self-directed behaviour to accomplish a task for different reasons, such as a mismatch between their traits, learning experiences, prerequisites, and learning environment. Hence, it is worthy to carry out a study on isolated pedagogical cases.

Focusing on the aspects of the learning environment, scientific literature pointed out that some of the lecturer's pedagogical style and mentoring role could positively influence the learners' self-direction. As stated by Grow (1991), cited in Bosch, Mentz, and Goede (2019), the learners' self-direction levels in learning can be influenced by the lecturer's choice of pedagogical styles (See Table 1). In other words, when the aim is to assist learners in being highly self-directed, it would be advisable that the lecturer adopts the resource-person pedagogical style.

Table 1: Grow's lecturer's pedagogical styles and learners' self-direction levels (Adapted from Bosch, Mentz, and Goede, 2019)

Expositor	**Guide/motivator**	**Facilitator**	**Resource person**
Content transfer, proactive interventions	*Stimulation, alternating content transfer, and student-centred activities such as the project-based learning*		*Assistance and guidance on request (reactive interventions)*
-- **Low**	**-** **Moderate**	**+** **Intermediate**	**++** **High**
Passive and dependent	Interested and motivated	Involved and committed	Self-directed and initiated

The following framework of mentoring roles (See Figure 1) was developed based on the literature suggesting that learners' self-direction can be promoted by implementing student-centred teaching approaches and adopting the roles of activator and observer.

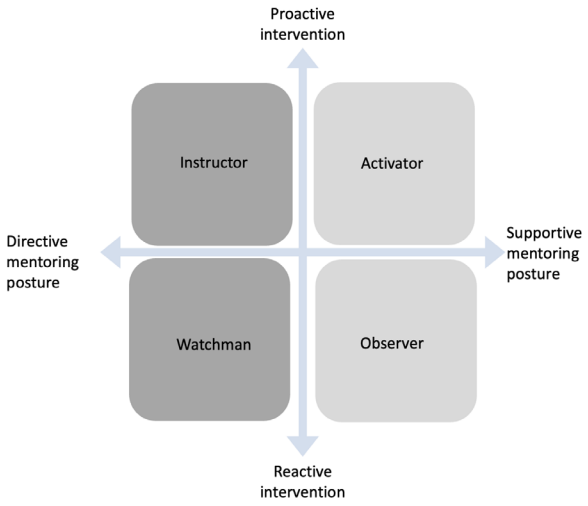

Figure 1: The Framework of mentoring roles (Adinda, 2020)

2.2 Reversed classroom: Opportunities and challenges

The flipped classroom allows student-centred learning activities by taking responsibility for their learning under the guidance of the lecturer. According to Lim, Cho, and Kim (2016), in a flipped classroom, face-to-face sessions focus on student-centred activities (discussions, problem-solving, and practical exercises). It may also concern the presentations of what learners have previously learned or prepared in their online learning environment.

French literature recognizes the reversed classroom as an advanced form of the flipped classroom that aims to promote the learners' creativity and deep learning by reversing the learning instruction and the lecturer and learner roles in class (Cailliez, 2017). One of the first challenges is that the reversed classroom lies in learners producing the contents of their module, ensuring its transfer, and facilitating the assimilation of the contents by the participants or their classmates (Cailliez, 2017). It also involves a postural shift as it asks learners to take on some of the lecturer's responsibilities, notably managing the knowledge transfer for other learners. Consequently, their activities include the definition of the learning objectives, the design and the creation of the learning content, the transmission of the learning content, and the learning assessment. Paul (2020) defines a posture as an individual's way of relating to others and introducing their intention. Indeed, the postural shift does not only influence the design and delivery of the training. It would also change the learner conceptions of the learning and the teaching activities, which are influenced by various aspects, including their learning experiences and beliefs.

In the reversed classroom setting, learners adopt the role of a lecturer and complete various activities to experience deep learning (Cailliez, 2017). This situation requires creativity, willingness, and initiative, which implies learner aptitude to identify their targets and needs (Hadji, 2012). It also includes the best strategies to adopt and the resources they may use to achieve their goal and assess their progress (Carré, 2010). Considering that these elements are necessary for self-direction, we hypothesise that (H1) the reversed classroom promotes learners' self-direction and (H2) encourages the development of the targeted competencies. Regarding the mentoring roles, we also hypothesise that (H3) learners are more likely to self-direct their learning when the lecturer adopts the resource-person pedagogical style and the two roles implying supportive mentoring postures, namely the activator and the observer. However, it is essential to note that online learning was new for learners of the study program. Therefore, this information and the literature review on the studied subjects allow us to ask the following questions: How do learners experience online reversed classroom learning? Does it encourage them to self-direct their learning? What competencies do they develop in the course? Are the competencies targeted by the studied course? Which pedagogical style and mentoring roles are adopted by the lecturer? By focusing on the mentoring roles adopted by the lecturer and the instructional design of the learning environment, our study aims to investigate how reversed classroom learning promotes the learner's self-direction, influences their learning experience, and encourages them to build the competencies targeted by the course.

3. Methods

3.1 The instructional design of the course

This study was conducted in an online course entitled 'Creating Digital Content for Training'. This course aims to enable learners to design and produce training materials using multiple digital tools and platforms. All learners in the group had access as a student to all sandbox pages provided in Moodle® as well as the sandbox page to which they had lecturer access. Therefore, they can experiment and prepare their training module on their respective sandbox page.

Learners had to choose one of ten different tools and platforms suggested by the lecturer and create a training module to be taught to their peers. The aim was to show how to design and create digital training materials using the chosen tool or platform. Learners' tasks include creating training supports (quiz, interactive videos, games, multimedia course contents, exercises), starting and managing discussion on the online forum of their sandbox page, conducting 25 minutes of online synchronous training, and preparing and evaluating participants' final production. For their training support, they were free to use the tools they were familiar with. However, they had to use H5P (Html-5-Package), a plugin tool used to produce and run interactive contents within an LMS such as Moodle®, to prepare at least two training supports.

The main Moodle® page of the course provided detailed instructions on these activities. They also had access to optional digital tools and platforms to enrich their training materials (See Table 2).

Table 2: Available sources of the course

<table>
<tr><th>Competencies targeted</th><th>Suggested tools and platforms to be chosen and presented</th><th>Mandatory tools and LMS to be used</th><th>Optional tools and platforms available</th></tr>
<tr><td rowspan="10">Design training materials

Produce an image, audio, and video with different digital tools and platforms</td><td>PowerPoint</td><td rowspan="10">Moodle®

H5P (available on Moodle®)

Online Forum (available on Moodle®)</td><td>Weebly</td></tr>
<tr><td>Prezi</td><td>Wooclap</td></tr>
<tr><td>Canva</td><td>Socrative</td></tr>
<tr><td>PowToon</td><td>Audacity</td></tr>
<tr><td>Genially</td><td>Kumullus</td></tr>
<tr><td>Kahoot</td><td>Imovie</td></tr>
<tr><td>Framindmap</td><td rowspan="4"></td></tr>
<tr><td>Google Classroom</td></tr>
<tr><td>Movie Maker</td></tr>
<tr><td>WordPress</td></tr>
<tr><td colspan="4">Other available sources:
Memos, articles, and examples of how to provide constructive, formative, and supportive feedback
Example of an assessment form</td></tr>
</table>

3.2 Study sample

All learners' responses remain confidential and anonymous. Participants in the study were undergraduate students at the University of Paris Nanterre, France. Most of them entered the program after several years of professional experience. For them, this was their first online learning experience. However, for other students who did not fit this profile, their only online learning experience was limited to during the Covid-19 crisis.

3.3 Data collection and analysis procedures

The study took place in the first semester of the academic year. On three occasions, all learners (N=8) were asked to complete a self-positioning survey and declare their perceptions of their competencies development. Additionally, at the end of the module, they were invited to describe their online learning experience in a questionnaire highlighting their activities in synchronous and asynchronous online learning. Finally, they also shared their views on how the adopted reversed classroom promoted their self-directed learning. The semi-structured interviews focused on the following aspects:

- The learners' perception of their self-direction, which includes their self-determination, self-regulation, and self-efficacy, in the reversed classroom learning setting
- The learners' perspectives on the lecturers' pedagogical styles (cf. Table 1) and mentoring roles (cf. Figure 1) in the studied context

Table 3 presents the research methods and the instrument analysis framework. We proceeded with a descriptive data analysis for the first and the second instruments. In contrast, the learner interview results (the 3rd instrument) were transcribed and analysed using thematic analysis (Braun & Clarke, 2006).

Table 3: Research methods and analysis framework

Instruments	Objectives	Analysis framework	Number of learners	Hypothesis
Self-evaluation survey (Open-ended questions)	Describe learners' perceptions of their competencies in the online reversed classroom	Descriptive analysis	8	H2: The reversed classroom learning encourages learners to develop the targeted competencies of the observed course
Questionnaire: Learners' report on the module (Likert and open-ended questions)	Describe learners' experience in the online reversed classroom			
Semi-directive interviews	Identify learners' perspectives on how the reversed classroom and the lecturer's pedagogical styles and mentoring roles promote their self-direction	Thematic analysis	3	H1: The reversed classroom learning promotes learners' self-direction H3: Learners are more likely to self-direct their learning when the lecturer adopts the resource person role and the two roles in which he or she is the supportive mentoring postures

4. Results

4.1 Learners' perspectives on their competencies

The learners filled out a self-positioning survey and declare the competencies they acquired. Their answers to the survey can be classified as follows:

- Designing training materials using multiple digital tools and platforms
- Producing an image, audio, and video with different digital tools and platforms
- Using digital tools and pack office (Word, PowerPoint, Excel)
- Using a Learning management system

The first two elements are specified in the course description and at the introduction of the course. The other competencies that cannot be classified within the list are grouped as the "Others."

In the first self-positioning survey, learners identified the available competencies they can use to help them complete various activities of the course and the competencies they think they need to succeed in the course. Table 4 below highlighted that, on the last self-positioning survey that took place in the last three weeks of the training, learners seemed to have all the competencies needed to succeed.

Table 4: The learners' statements on the competencies they have and what they might need to succeed in the course

Time	Competencies available	Competencies needed
T1 (Oct 15th)	Using digital tools and pack office (General use) Other competencies (General use of some of digital tools and platforms provided in the course)	Other competencies (Conducting and managing a training session) Producing an image, an audio file, and a video with different digital tools and platforms
T2 (Nov 11th)	Designing training materials using multiple digital tools Producing an image, an audio file, and a video	Using a Learning management system Other competencies (Manage a group of learners in a training session)

Time	Competencies available	Competencies needed
	with different digital tools Using digital tools and pack office Using a Learning management system	
T3 (Dec 17th)	Designing training materials using multiple digital tools Producing an image, an audio file, and a video with different digital tools Using a Learning management system Other competencies (Conducting and managing a training session)	

4.2 Learners' activities in the online "reversed classroom" learning setting

Through various questions, 100% of learners agreed that the lecturer had clearly announced the competencies targeted by the course program. All learners agreed that the course supported them in building the targeted competencies. In addition, the provided resources and activities were also helpful for their learning. The findings also highlighted that no learners experienced technical difficulties downloading the course material or accessing the synchronous online classes. Moreover, the learner considered themselves involved in the learning process.

Various synchronous and asynchronous activities were planned by the lecturer. According to the learners, synchronous learning assisted by the lecturer allowed them, in general, to have time to process the learning materials, discuss the problems encountered and gather some clarifications on various subjects related to the course. They also appreciated the synchronous interactions with peers, which allowed them to share various questions, subjects, difficulties, practices, and the progress of their module. In addition, they found that synchronous interactions were essential to creating a dynamic and friendly atmosphere within the group. Finally, they appreciated the asynchronous learning for providing them with opportunities to process the learning materials, to discuss topics related to the course, work together, get feedback on their work at their own pace, and have a written record of their discussion.

In sum, these results showed that synchronous and asynchronous learning activities did not indicate a remarkable difference in learners' learning strategies. A significant similarity was highlighted in the activities and objectives of their interactions during the synchronous and asynchronous learning time. These findings were confirmed by their response to our question about using the discussion forum and synchronous talk to help them understand the course materials.

4.3 Reversed classroom to target the learners' self-direction

Various themes related to the learners' self-direction were identified. Learners pointed out that the reversed classroom allowed them to satisfy the learning objectives targeted for each tool and platform, and to identify their objectives:

> *"I decided to choose a tool that I didn't know and that I always considered a difficult tool to work on … I wanted to break this fear and get out of my comfort zone and work on topics that I didn't know...and that I didn't master at all." (Learner 1).*

The interviews also highlighted the freedom to act learners recognised within the course and the fact that they were very proactive during the course in identifying their needs and peers'. In addition, they were also proactive in problem-solving.

> *"... some people tend to be late and to ask for more time, so I solve this problem differently …I offered a bonus for learners who were on time, to reward those who were serious about their work and who wanted to do the job…" (Learner 2)*

> *"I think they had a hard time understanding why, but then I wanted to link it to the theme (Memory) ... but not everybody has the same understanding of the subject (and) has done studies*

> *related to that ... That is why ... I would have given the liberty to execute the task on a theme that interests them the most…" (Learner 3)*

Indeed, our interviews confirmed that the reversed classroom promotes learners' self-direction. The freedom to act, the proactivity, and the capacity to integrate given learning objectives and identify theirs indicate one's self-determination. They also declared they took the opportunity to control their learning activities and strategies and take a critical view of their learning environment and their actions, which related to self-regulation, the second dimension of self-direction. Finally, they also felt capable to set their own goals and execute tasks. These elements related to their self-efficacy.

4.4 Lecturer's mentoring roles and pedagogical style

Regarding the lecturer's mentoring roles and pedagogical style, the interview results pointed out that the lecturer adopted various mentoring roles depending on the objective of the activities. At the beginning of the semester, to present learning activities and assessments and the use of mandatory tools (Cf. Table 2), the learners stated that the lecturer adopted the role of the instructor (with a proactive intervention style and directive mentoring posture). The lecturer also adopted the activator mentoring role to assist learners in preparing their modules. According to Learner 2, this role was mainly adopted. However, for Learners 1 and 3, the observer's role (with reactive intervention style and supportive mentoring posture) was mainly adopted. Indeed, in the same learning situation, students could consider the lecturer adopting a proactive or reactive intervention along with a supportive mentoring posture (role of Activator and Observer) according to their stand on the problem encountered and learning progress.

Regarding the pedagogical styles, the facilitator and the resource person styles were the most present. However, the lecturer adopting the expositor and the guide styles were less remarkable. According to Learners 1 and 3, the expositor style can be perceived through Moodle®'s course description and task instructions, notably during its presentations in synchronous meetings. For Learners 1 and 2, the guide's style was notably adopted at the beginning of the semester, along with the expositor style. These findings show that learners can also have various stands on the lecturer's pedagogical style depending on their understanding of the learning activities and their learning progress. Furthermore, they all agreed that the lecturer's various mentoring roles and pedagogical styles did not bother the learning process. Instead, it helped them adjust their learning strategies for their first learning experience in an online reversed classroom.

These findings revealed that all mentoring roles and styles worked well to promote students' learning in an online reversed classroom. One of the most valuable aspects to note while identifying an appropriate mentoring role and pedagogical styles is the alignment of its aims with the progress of students' learning process in a reversed classroom.

5. Conclusion

Our contribution aimed to investigate a reversed classroom learning setting and its effects on learning. This study explores the learners' experience in their first online reversed classroom, the competencies they develop in this learning setting, the influence on their self-direction and the perception of the lecturer roles and their evolution during the course. Furthermore, three out of the eight enrolled students were interviewed to deepen their understanding of the effect of the reversed classroom on their learning experience, self-direction in learning and views on the lecturer's mentoring roles and pedagogical style for their learning.

The first hypothesis that reversed classroom learning promotes learners' self-direction is confirmed. The findings point out that the reversed classroom scenario allowed learners to integrate the objectives set by the lecturer for the course and identify and pursue their own learning goals and the ones targeted by their modules for classmates. The interviews also confirmed that the reverse classroom allowed the learners the freedom of action and take initiative in preparing their module and its conduct. Moreover, the learners act proactively, especially in identifying and fulfilling their needs and those of their peers. The learners are also more proactive in problem-solving and managing control over their activities. In addition, they also stated that the reversed classroom allowed them to have a critical view of the learning environment and their actions. Finally, it allowed them to develop the competencies they pursue and increase their self-confidence. It represents the self-direction defined by Hadji (2012) and the two essential dimensions of self-direction: self-determination and self-regulation pointed out by Cosnefroy & Carré (2014).

The learners' answers in the interviews and survey prove they felt competent and acquired the target competencies. They even identified some additional skills they have developed not specified in the course description. Moreover, the learner self-evaluation report also highlighted that in the last three weeks of the training, they considered themselves capable of completing the exercises provided in the modules prepared by their peers and successful during the course. Indeed, these findings confirmed our second hypothesis that the reversed classroom promotes the development of the competencies targeted by the course program.

Our third hypothesis is partially confirmed since the findings showed that almost all mentoring roles and all pedagogical styles were adopted. Furthermore, the interviews highlighted the positive impact of these roles and pedagogical styles for learning. As such, the adopted mentoring roles and pedagogical styles promoted the learners' self-direction. The interviews also revealed that each mentoring role and pedagogical style could be effective when it found its goals aligned with the learning progression. In line with Carré (2003), this study confirms that the freedom provided in the learning environment or the adopted learning approach, such as the flipped classroom, through the resource-person style (cf. Table 1) and the role of activator and observer (cf. Figure 1), does not necessarily promote the development of the learners' self-direction. In the observed case, among the pedagogical styles studied, the learners also appreciated the three other styles, namely the facilitator, expositor, and guide, for specific learning time and to answer certain learning needs. As for the mentoring roles, the role of the instructor, in which the lecturer was directive and proactive, did not disrupt the learning process since it was adopted at the right time, so it corresponded to the learners' needs. The adoption of the pedagogical styles and mentoring roles, which are not in line with the presence of self-direction in learning as stated by the literature (Bosch, Mentz, and Goede, 2019; Adinda, 2020), was brief compared to the other mentoring roles and styles stated in our hypothesis. However, it first respected the conditions and aims of a reversed classroom (Cailliez, 2017), and complied with the learners' progress in the course, and their needs.

To conclude, this study pointed out that the positive influence of the reversed classroom on learning is not automatically achieved. Additionally, learners' learning experience and their self-direction in learning were also related to mentoring roles and pedagogical styles the lecturer provided, which were adopted depending on the learning activities and learners' learning progress. This variety in the learning environment promoted the implementation of multi-modal training and allows the learners to have multiple learning episodes (Lieury, 2020) that would foster the learners' engagement in online learning.

The learners appreciated synchronous activities for the opportunity to interact and discuss synchronously. They also valued asynchronous learning for the opportunity to learn and organise their work at their own pace and to have personalised and written answers to their questions. Indeed, the identified learners' activities in the online reversed classroom for synchronous and asynchronous learning modalities are commonly found in other non-reversed online learning. Hence, for further research, it is interesting to know if the reversed classroom could help reduce the transactional distance (Jézégou, 2022) in an online learning context.

Finally, some limitations need to be considered. The sample size is not large enough to obtain results that can be generalised. Having greater diversity in learners' profiles and learning experiences will be useful since this study only managed to interview learners who might have been more ready for self-directed learning. Consequently, our future research aims to study a larger sample of learners and lecturers to compare the influence of different lecturer roles and the teaching strategies to develop the learners' self-direction in an online reversed classroom.

References

Adinda, D. (2020) Stratégies d'accompagnement des étudiants en formations hybrides et effets sur l'autodirection dans l'apprentissage (Doctoral dissertation) University of Strasbourg, Strasbourg.

Bosch, C., Mentz, E. and Goede, R. (2019) Self-directed learning: A conceptual overview. In: Mentz E., De Beer, J. Bailey, R. (eds). Self-directed learning for the 21st century. Aosis, Durbanville.

Braun, V. and Clarke, V. (2006) "Using thematic analysis in psychology". Qualitative research in psychology, Vol 3, No. 2, pp. 77-101.

Cailliez, J.-C. (2017) La classe renversée—L'Innovation pédagogique par le changement de posture. Ellipses.

Carré, P. (2003) "La double dimension de l'apprentissage autodirigé Contribution à une théorie du sujet social apprenant". Canadian Journal for the Study of Adult Education, Vol 17, No. 1, pp. 66-91.

Carré, P. (2010) L'autodirection des apprentissages. In: Carré P., Moisan A., Poisson D. (eds), L'autoformation, perspectives de recherche. Press Universitaire de France, Paris.

Carré, P., Jézégou, A., Kaplan, J., Cyrot, P. et Denoyel, N. (2011) "L'Autoformation: The state of research on self-(directed) learning in France". International journal of self-directed learning, Vol 8, No. 1, pp. 7-17.

Cosnefroy, L. et Carré, P. (2014) "Self-regulated and self-directed learning: Why don't some neighbors communicate?" International journal of self-directed learning, Vol 11, No. 2, pp. 1-12.

Dynan, L., Cate, T. et Rhee, K. (2008) "The impact of learning structure on students' readiness for self-directed learning". Journal of education for business, Vol 84, No. 2, pp. 96-100.

Hadji, C. (2012) Comment impliquer l'élève dans ses apprentissages : L'autorégulation, une voie pour la réussite scolaire. ESF éditeur, Issy-les-Moulineaux.

Hiemstra, R. (2015) "Faciliter l'apprentissage autodirigé des adultes". Savoirs, Vol 1, No. 37, pp. 53-73

Jézégou, A. (2008) "Formations ouvertes et autodirection de l'apprenant". Savoirs, Vol 16, No. 1.

Jézégou, A. (2022) La présence à distance en e-formation. Presses universitaires du septen-trion.

Lieury, A. (2020) Mémoire et réussite scolaire. Dunod.

Lim, C., Cho, Y. H. et Kim, S. (2016) Partnerships and Innovation for Blended Learning at Seoul National University, Republic of Korea. In: Cher Ping L., Libing w (eds), Blended Learning for Quality Higher Education: Selected Case Studies on Implementation from Asia-Pacific, Unesco - Bangkok Office, Bangkok.

Paul, M. (2020) La démarche d'accompagnement : repères méthodologiques et ressources théoriques. De Boeck Supérieur, Louvain-la-Neuve.

Ponton, M.-K. et Carr, P. B. (2012) "Autonomous learning and triadic reciprocal causation : A theoretical discussion". International journal of self-directed learning, Vol 9, No. 1, pp. 1-10.

Rimini, M. and Spiezia, V. (2016) Skills for a digital world. OECD Digital Economy papers.

From Flipped to Remote to Hybrid: Transformation of a Game-Based Flipped Classroom During the Covid-19 Pandemic

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Abstract: Purpose – This research examines how students' learning was affected by the transition from a flipped classroom model to remote learning during the Covid19 lockdown and hybrid learning after return to class. Methodology – This study features quantitative analysis of undergraduate students' online interactions with the course material over two semesters with the same instructor, one completely online, the other in the form of hybrid learning imposed by Covid19 restrictions. Participation in the game-based quizzes before class, in-class multiplayer game sessions, and presence in the classroom or online during the lectures were measured, as well as the students' score to the final exam. Students also took a survey at the end of each semester to provide feedback on the course. Finally, interviews were made with some of the students to document their detailed impression of the learning challenges of the period. Findings – Results from this study identified four groups of students with different attitudes regarding learning and challenges during and after Covid19 restrictions. Some came back immediately in the physical class while others remained online or did both. Average scores correlate increased face-to-face time and regular online preparation before class with better results in the final exam. Qualitative data from students' interviews confirm these changing attitudes to learning due to Covid19. Practical implication – This study allows us to reflect on best practices for hybrid learning and opportunities to improve on the flipped classroom model under changing modes of delivery. Furthermore, it underlines strategic importance to engage different profiles and challenges for students with less time and opportunity to engage in face-to-face learning. Interest – While research on flipped and hybrid classrooms is prevalent, little has been done in comparing the two models and their impact on students' learning attitudes Furthermore, research on classroom adaption and adjustment during Covid19 is still at early stages. This study presents opportunities and challenges for the hybrid classroom moving forward.

Keywords: flipped learning, hybrid learning, emergency remote teaching, game-based learning, COVID-19

1. Introduction

The coronavirus (COVID-19) was declared a global pandemic on 12 March 2020. The virus spread rapidly worldwide, and prevention of contamination quickly became a global issue. The WHO recommended several public health and social measures (PHSMs) to suppress SARS-CoV-2 including but not limited to personal protective measures (e.g., physical distancing, hand hygiene, mask-wearing); environmental measures (e.g., cleaning, disinfection, ventilation); and physical distancing measures (WHO, 2021). High Education Institutions (HEI) were largely affected by the social distancing measures, with many schools and universities having to move their teaching online (Triyason, Tassanaviboon, and Kanthamanon, 2020). While online education had been used before and widely tested for its flexibility and convenience, this sudden shift was dubbed Emergency Remote Teaching (ERT) owing to the specific time and resources constraints that triggered its use during COVID-19 (Hodges et al., 2020). Institutions adapted to the new context, but rapid changes and uncertainty had a huge impact on both educators and students, who frequently reported increased stress, risk of depression, lack of motivation and difficulty focusing (Birmingham et al., 2021). As restrictions were lifted, the possibility of returning to campus was seen as desirable both for social interactions and improvement in education quality.

In the Aalborg University (AAU) department of Medialogy, the adaption came quickly since some classes had already adopted a flipped classroom (FC) model (Triantafyllou, 2015), with extensive use of Moodle as a Learning Management System (LMS) for online delivery of content and tests. Courses moved fully online over Fall 2020 and Spring 2021, and presence on campus started again in Fall 2021. During that time, we endeavoured to gamify our FC with the introduction of games to support the students' learning experience (Algayres and Triantafyllou, 2019). The gamified learning experience was moved fully online during the Spring semester and to hybrid form in the Fall semester of 2021, with the introduction of a collaborative game for students in the physical classroom. Both online and hybrid models were made necessary by the physical distancing mandate, and the necessity to maintain isolation for symptomatic or contact cases. During that time, the introduction of Game-Based Learning (GBL) elements allowed us to have a specific window into the students' online habits and learning challenges.

With this sudden influx of data and quick adaption to different learning circumstances, we started investigating the process of returning on campus with the hybrid classroom format, and asked ourselves the following research questions:

- RQ1: was the implantation of a hybrid classroom beneficial to the students' learning?
- RQ2: did the students' learning habits change after COVID-19 and during the implementation of the hybrid format?

The structure of the article is as follows: we present the literature background, the methodology for the implementation of the gamified classes, the results of the experiment, and discuss the potential and limitations of hybrid learning with GBL elements.

2. Background literature

2.1 Remote, flipped, hybrid: different modes of online delivery

Online teaching and research in eLearning have been increasingly developing fields. Traditional teaching is still conceptualized as face-to-face, "seat time" in person with the instructor, but forms of online delivery have become extremely diverse. Technology-enhanced learning incorporates IT tools to traditional delivery (e.g., a LMS to access learning material and computerized homework), blended models mix face-to-face time with online learning time, whereas in fully online course students never meet physically (Van Wart et al., 2019).

The FC is a model of blended delivery that use online resources to flip traditional concepts of class work and homework. It divides instruction in two parts, "interactive group learning activities inside the classroom, and direct computer-based individual instruction outside the classroom" (Bishop and Verleger, 2013). On a practical level, FC move most lecture time out of class, use class time for active and social learning activities and require students to complete pre- and/or post-class activities with online support to fully benefit from in-class work (Abeysekera and Dawson, 2015).

Hybrid learning aims at adapting to the need for more flexibility by enabling synchronous virtual classrooms to connect both onsite students and remote students during teaching time. Research in hybrid learning appears still in early stages although interest in this form has expanded in the wake of the COVID-19 crisis (Raes et al., 2019).

Finally, ERT borrows tools and techniques from online learning but is different in that it constitutes a "temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" (Hodges et al., 2020). It involves fully remote teaching solutions but with the aim to provide instructional continuity for the limited crisis time, not fully incorporate online instruction.

The advantages of various forms of online delivery have been extensively researched in the decades following their introduction. Van Mart et al. (2019) showed that online learning allowed to provide education with reduced expenses for students and faculty, gave flexibility for the students who need asynchronous learning to fit their schedule, and could improve their digital skills. Similarly, studies have shown that the FC presents many advantages such as students learning at their own pace, teachers being able to better support their students, more classroom time for hands-on and collective activities, and students gaining more autonomy in the learning process (Herreid and Schiller, 2013). Abeysekera and Dawson (2015) propose that due to the active participation of students, "[learning] environments created by the FC approach are likely to satisfy student needs for competence, autonomy and relatedness and, thus, entice greater levels of intrinsic motivation". Finally, early research into the hybrid format points to similar benefits. Hybrid learning has two main advantages in organization and pedagogy. It can reach a greater base of students who are working or ill, and can interact with the teacher synchronously, benefiting from direct interaction (Raes et al., 2020).

There are however challenges with online learning. Motivation in students can be harder to sustain without presence time with the instructor and the fellow students, also called social presence (Van Mart et al., 2019). Raes et al., 2020 qualified this phenomenon of 'ambiguity' regarding group membership. The FC model is extremely dependent on student coming prepared to the class, and lacking preparation time the pedagogy is less efficient. (Herreid and Schiller, 2013). Similarly, in hybrid learning students can feel disconnected and experience less relatedness compared to their in-class peers, and technical requirements must be solid to

guarantee audio quality for all (Raes et al., 2020). Finally, Smith (2021) showed that reduced face time in a hybrid configuration did not worsen students' perception of their education quality and that they appreciated its flexibility, but that their test performances were negatively impacted.

2.2 Game-based learning

GBL is similarly a well-established field in educational research. Game-based learning (GBL) can be defined as an environment where game content and game play enhance knowledge and skills acquisition, with challenges that provide playing students with a sense of achievement (Qian and Clark, 2016). Gaming elements have been introduced in the classroom in a variety of forms: serious games (Michael and Chen, 2005), Digital Game-Based Learning (Prensky, 2003), and gamification, i.e., inclusion of gaming mechanics such as scores and levels to improve experience and engagement (Muntean, 2011).

Research into GBL has focused both on the challenges of evaluating the impact and benefits of GBL and the best practices to implement them in the classroom. Although some studies underline the difficulties of proving an educational benefit from GBL (Young et al., 2012), others insist that it has positive outcomes. Abdul Jabbar et Felicia (2015), in an extensive review, show that gaming provides opportunities for players to gain from the gameplay, and that GBL helps students to develop skills and knowledge and strengthens their ability to handle their learning experience. They also defend the efficiency of games that combine both a competitive element for engagement and a collaborative aspect since socializing is a driving factor in the efficiency of GBL. De Freitas (2006) argues that games can be extremely immersive and collaborative environments but necessitate sustained motivation and clear learning outcomes for the participating students. They also underline the fact that GBL is often experience-based or exploratory, and therefore a good support for experiential, problem-based learning approaches. Similarly, Young et al. (2012) defend the idea that digital-learning games target the acquisition of knowledge as its own end and foster mind and understanding habits that are generally useful within an academic context. Finally, Qian and Clark (2016) researched the capacity of GBL to improve 21st century skills (i.e., critical thinking, creativity, collaboration, and communication) and showed that GBL brought both improved attitudes to learning and cognitive gains.

Finally, recent reviews present two different trends: the first one leaning into more complex and fully integrated learning environments (De Freitas, 2006), the second towards more simple approaches like puzzle based and simple game mechanics, allowing quick engagement, easily understood educational relevance, and short efficient duration of play (Abdul Jabbar and Felicia, 2015). In an extensive literature review, Kay and LeSage (2009) showed that quizzes and polls have proven to be an effective educational tool as students attended more classes, paid more attention, and were more engaged. Similarly, Raes et al. (2020) found that their students' intrinsic motivation was higher during quiz times than during other moments of the lecture. Therefore, the overall tendency points to the benefits of using GBL especially in the context of active learning or problem-based learning, with the main limitation that GBL needs to be supported by clear learning objectives, sustained student engagement, and reliable technological support.

2.3 Emergency remote teaching during COVID-19

Framing and analysing the students' learning experience during and after COVID-19 remains complex. Studies emphasize the challenge of adapting quickly to the online format and unique temporary nature of ERT (Hodges et al., 2020) According to a survey conducted by Marinoni, Van't Land and Jensen (2020), two thirds of HEI respondents implemented distance teaching and learning, experimenting challenges technical infrastructure, skills, and pedagogies, but also opportunities to explore blended and hybrid learning. Recommendations to adjust to the COVID-19 crisis included development of reliable network infrastructure, investment in more affordable technological devices, training initiatives, and diverse modalities in delivering flexible learning experiences (Ferri, Grifoni, and Guzzo, 2020).

Other studies underlined that teachers' presence and quality of content were the major factors that influence student engagement online during lockdown (Khlaif, Salha, and Kouraichi, 2021), as well as strong and timely communication, clear organizational structure and expectations, and accommodation of multiple learning styles (Wiltse et al., 2020).

Finally, tentative studies into the hybrid mode of delivery showed its potential. Reas et al. (2020) in their review state the potential of synchronous hybrid learning, which creates a more flexible, engaging learning environment. To improve the model, they also recommend clear communication, an active lecturer that frequently ask oral questions, and cognitively activating activities such as polls and quizzes presented in an active and amusing manner.

3. Methodology

3.1 The structure of the course

This study covers the two semesters of the year 2021, the Spring semester (Semester 1) and Fall semester (Semester 2). This study followed the same group of students engaged in a Medialogy bachelor course, representing the second and third semester of their ten-semester study program. The courses evaluated were programming courses followed by the same group of students (n=47). The methodology for this study is presented in figure 1.

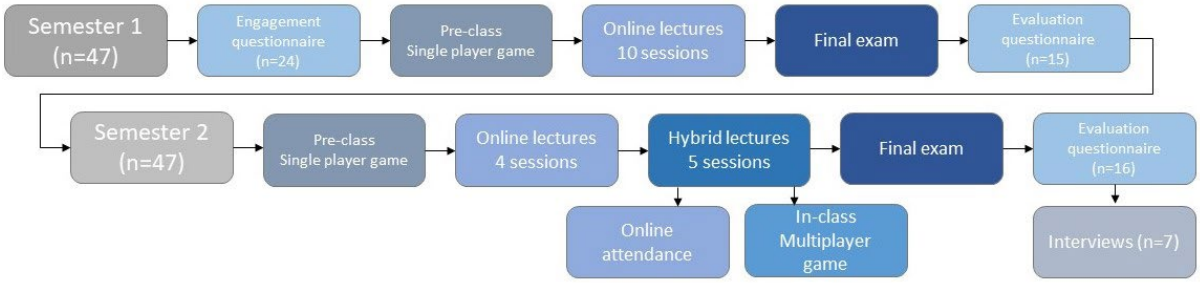

Figure 1: Methodology for the implementation and evaluation of the Medialogy 2021 programming courses

The lectures for Semester 1 took place online. The students had to prepare before each lecture, access the learning material and play the pre-class quiz game. During Semester 2, the requirements for pre-class preparation and single player quiz game remained the same. However, the nine lectures were split: the first four lectures were delivered online, the last five were delivered in hybrid format. The students that were physically present started class with a multiplayer quiz game session, other students followed the lecture online.

3.2 The game implementation

Both courses exploited a game to enhance the learning experience: a game quiz like popular application Quizlet, for facility of implementation and easy to understand learning objectives. The game has two modes: single player (SP) and multiplayer (MP). Figure 2 presents a capture from the SP game screen, figure 3 a capture from both MP game screens, and a picture of the game being played in class.

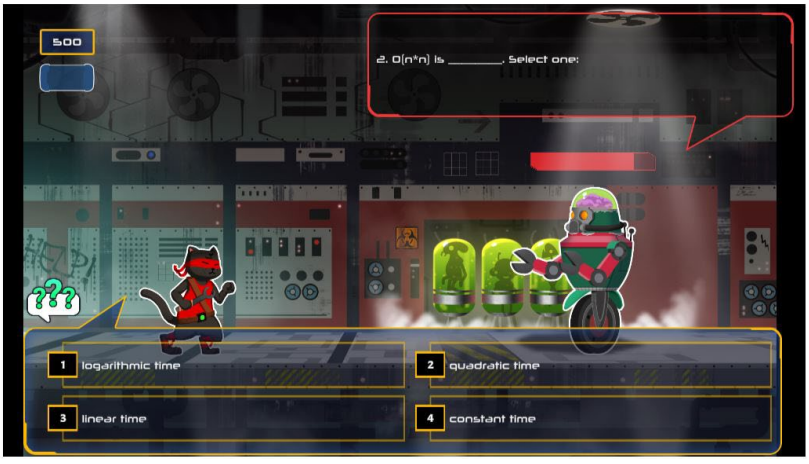

Figure 2: Screen capture of the SP game

Figure 3: Screen capture of the MP game and game activity in class (October 2021)

Semester 1 had 11 SP game sessions for a total of 106 questions. Semester 2 had eight SP game sessions for a total of 53 questions, and five MP game sessions. Due to the differences in structure for both iterations of the SP games, to compare them we included in the output the scores per game session and per question.

The games were implanted on a dedicated platform. This gave us information about the students' activity (engagement time, scores, number of right and wrong answers, MP participation), allowed adjustment of the quizzes to each lesson, as well as targeted interventions towards the lesser-engaged students. Due to COVID-19 constraints, the MP game was only implemented during Semester 2, allowing us to map the number and activity of the students who returned physically on campus.

3.3 The evaluation tools

We decided to use mixed methods for the study to cover the diversity of students' experiences through various data. Our primary source was quantitative indicators from the gaming platform and LMS: number of quiz sessions completed, score per session, engagement time, MP participation, online attendance, and final assessment score. This hard data allowed us to track the regularity and performance of the students. We also decided to use a questionnaire and interviews to record the students' perception of their learning experience: out of 47 students who completed the engagement questionnaire, 15 filled the feedback for Semester 1 and 16 for Semester 2. Students were selected for interviews on a voluntary basis among the respondents.

Our focus determined the choice of methodology. For RQ1 (benefits to students' learning), we could exploit data from the students' performance both summative and formative, as well as their self-reported perception of the class efficiency. Similarly, for RQ2 (students' learning habits) we used both hard data from their online behaviour as well as their subjective, but also relevant, perception of the learning process.

4. Results

Table 1 presents an overview of the results for both semesters. The final exam result average was better in Semester 2 by ten points on a maximum of 100. The game scores are expressed in points, each correct answer valued at 500 points. The average score for the SP was higher during Semester 1 but the average score relative to the number of questions was higher during Semester 2 by more than 100 points. Similarly, the engagement rate (time spent on the game expressed in seconds), was significantly higher during Semester 2, with students spending an average of three minutes by game session time. The MP game score, available only for Semester 2, is rather weak with an average of 1456 points, which is explained by the fact that only a minority of students took part in all the game sessions.

We then studied attendance during the time in Semester 2 when the course format turned hybrid. We listed the students who participated in the MP game, those who attended physically without playing the game (usually due to arriving late and missing out the game session), those who attended online synchronously and those who did not attend at all. We also looked at the students who completed the SP game to prepare for the

classes before the end of the lectures, and those who took the SP game quiz after the course was ended. Figure 4 presents the conclusions of these observations.

Table 1: Overview of the study's quantitative indicators

	Semester1	Semester 2
Final score (average/100)	74,36	84,13
Average score MP game (points)	NC	1456
Average score SP game (points)	48659	30590
Sum Average Engagement (seconds)	151	1482
Average score by session (points)	4423	3824
Average score by question (points)	459	578
Sum average engagement by session (seconds)	14	185
Sum average engagement by question (seconds)	1,42	27

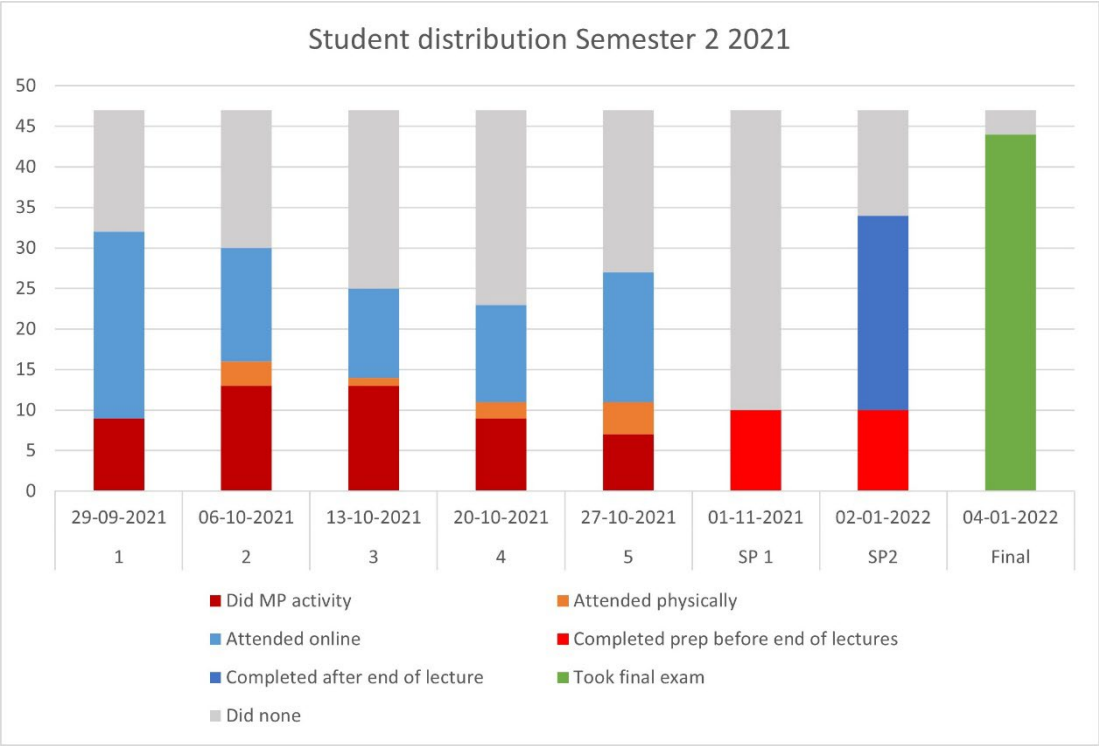

Figure 4: Student distribution and participation during Semester 2

We can observe that most students struggled to reconnect with the classroom, whether online or in person. We can also observe that a very small minority, ten students, did the activity to prepare for the class as intended. A significant part of the students completed the quizzes, but towards the end of the semester as preparation for the exam. Finally, most students took and completed the exam.

Looking closely at those results we sorted the students in six different groups. The groups were based on the following characteristics:

- Group A: the present and active. Participated to at least three MP sessions
- Group A': the well-prepared. Completed the pre-class preparation before the end of the lectures. This group comprises 5 students of group A, 3 students of group B and 2 students of group C
- Group B: the connected active. Attended most hybrid classes online.
- Group C: the irregulars. Attended less than two classes (physically or online).
- Group D: the "last minute" students. Completed quizzes or final examination after the end of the lectures.
- Group E: the dropouts. A minority of students did not take the final examination at all.

Table 2 presents the quantitative indicators for each of these groups. This distribution shows us that the students who were consistent with pre-class preparation as well as the students who were active physically in class got a slight advantage in their final examination results compared to the other groups. We can also underline that the students who followed the courses synchronously online do not present significant different results from the last-minute student group. This can be explained by the fact that some of the last-minute students are high performing students who do not feel the need to work regularly and can succeed by mobilizing at the very end of the semester.

Table 2: Quantitative indicators for each group based on class attendance and online interactions

Group denomination	Number of students	SP average score (pts)	SP average engagement (s)	MP average score (pts)	Examination average final score (pts/100)
Group A	10	44806,2	1655,8	5300	91,2
Group A'	10	44968,7	1552,2	3300	92,7
Group B	13	33802,85	291,67	1766,77	90,69
Group C	10	26024,9	1150,2	1050	90,6
Group D	11	24784,09	1487,36	0	87
Group E	03	5791,66	753,66	0	0

The quantitative indicators argue in favour of the benefits of returning to campus for students and more personal interactions. Qualitative comments from the feedback questionnaires and interviews seem to support this observation. Figure 5 presents the word cloud of these interviews.

Figure 5: Interviews word cloud by frequency of mentions

First, the students were mostly positive about returning to campus. Several answers mentioned the challenge of interacting online, and that being present physically allowed them to ask questions and seek the teachers' help more easily. Quote: *"I feel like it's more intimidating to answer questions on Teams rather than in real life. I prefer asking questions in real life because it feels more natural and less intimidating."* (Questionnaire, Semester 1), *"So, I thought it was a bit harder whenever I was online. But as soon as we had [teacher] in a classroom, it was a much nicer experience because everyone was present and there was a bit more social norm to be quiet during the lectures."* (Student F)

Some students expressed difficulties adjusting. Quote: "*There's kind of this vibe that's been changed in a way. There's (…) habits that are hard to break, (…) going to the place and being in the seminar room when you had to get used to do it from home*." (Student A)

Students finally mentioned continued use of online tools, and especially appreciated being able to access the lectures online. Quote: *"One thing I really like now that even if we're back physically, is that we still are using the online space, such as teams, to have the availability of the online classes."* (Student F) "*I think it's awesome to always record the lectures because I often I download them to my cloud, and I listen to them on my way to school.*" (Student A)

5. Discussion

- RQ1: was the implantation of a hybrid classroom beneficial to the students' learning?

Our study show that students benefited from the implantation of the hybrid format. The students who took full advantage of the tools at their disposal got better average results than students who worked fully online. The students' survey responses show general satisfaction with the conduct of the courses.

This study aligns with conclusions of previous works regarding the potential of hybrid learning as a sustainable and valid mode of blended learning delivery. The best features of hybrid learning remain organisational flexibility and pedagogical. The current political and environmental trends remain uncertain: it is very probable that modern societies will face other epidemic spikes and climatic crisis. In this context, building robust infrastructures and educational model to support hybrid learning and quick adaption to changing circumstances appear of paramount importance.

- RQ2: did the students' learning habits change after COVID-19 and during the implementation of the hybrid format?

The students' learning habits do not appear to have changed in depth, although some students reported struggles to get back to physical learning. The hybrid format however has the potential to reinforce digital usages that were in place before. In that regard, there is potential in investigating how to adapt the best practices of the FC to the hybrid format. This aligns with previous research showing that with the right tools, solid technological backup, and emphasis on interesting and playful activities, hybrid learning can deliver a motivating learning experience. In the future, we may see more adaption of students and educators to changing circumstances of classroom delivery, and consolidation of digital habits that support this kind of flexibility.

There are however limitations to this study: we only followed a single class, and the multiplicity of concurrent parameters (including ERT, hybrid learning and GBL) does not permit to determine precisely which practices supported the better learning outcomes in our students. While our research seems to confirm the benefits of hybrid learning, it is still a relatively new field, and more research is needed to understand the long-term impact of COVID-19 on education.

6. Conclusion

This paper presents data from two semesters of teaching with the same students, with ERT during lockdown and hybrid classes after reopening, while introducing a GBL approach. Students had better results during Semester 2, with better learning outcomes for students who were more physically present and active, and consistent in working regularly. Students were positive with being able to both return in class while being able to follow the lectures online when necessary and have easy access to the learning materials. This aligns with current research in the potential of hybrid learning, especially in conjunction with active learning activities and pedagogy.

More research will be needed to fully assess the potential of hybrid classes and the impact of COVID-19, but facing this crisis also allowed us a new insight in our teaching practices and our students experience, and a better understanding that will be useful to adjust to future crises should they arise.

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References

Abdul Jabbar, A.I. and Felicia, P. (2015). Gameplay engagement and learning in game-based learning: A systematic review. *Review of educational research*, 85(4), pp.740-779.

Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: Definition, rationale, and a call for research. *Higher Education Research & Development*, 34(1), 1-14.

Algayres, M. and Triantafyllou, E. (2019). An educational model for integrating game-based and problem-based learning in data-driven flipped classrooms. In *International Symposium on Emerging Technologies for Education* (pp. 145-154). Springer, Cham.

Birmingham, W. C., Wadsworth, L. L., Lassetter, J. H., Graff, T. C., Lauren, E., & Hung, M. (2021). COVID-19 lockdown: impact on college students' lives. *Journal of American College Health*, 1-15.

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. In *ASEE national conference proceedings*, Atlanta, GA (Vol. 30, No. 9, pp. 1-18).

De Freitas, S., (2006). *Learning in immersive worlds: A review of game-based learning*. JISC e-Learning programme.

Ferri, F., Grifoni, P. and Guzzo, T. (2020). Online learning and emergency remote teaching: Opportunities and challenges in emergency situations. *Societies*, 10(4), p.86.

Herreid, C. F., and Schiller, N. A. (2013). Case studies and the flipped classroom. *Journal of College Science Teaching*, 42(5), 62-66.

Hodges, C.B., Moore, S., Lockee, B.B., Trust, T. and Bond, M.A., 2020. The difference between emergency remote teaching and online learning.

Kay, R. H., and LeSage, A. (2009). A strategic assessment of audience response systems used in higher education. *Australasian Journal of Educational Technology*, 25(2), 235–249.

Khlaif, Z.N., Salha, S. and Kouraichi, B. (2021). Emergency remote learning during COVID-19 crisis: Students' engagement. *Education and information technologies*, 26(6), pp.7033-7055.

Marinoni, G., Van't Land, H. and Jensen, T., (2020). *The impact of Covid-19 on higher education around the world*. IAU global survey report, 23.

Michael, D. R., and Chen, S. L. (2005). *Serious games: Games that educate, train, and inform*. Muska & Lipman/Premier-Trade. Thomson Course Technology, Boston.

Muntean, C. I. (2011). Raising engagement in e-learning through gamification. In *Proc. 6th International Conference on Virtual Learning ICVL* (No. 42, pp. 323-329).

Prensky, M. (2003). Digital game-based learning. *Computers in Entertainment (CIE)*, 1(1), 21-21.

Qian, M. and Clark, K.R., (2016). Game-based Learning and 21st century skills: A review of recent research. *Computers in human behavior*, 63, pp.50-58.

Raes, A., Detienne, L., Windey, I. and Depaepe, F. (2019). A systematic literature review on synchronous hybrid learning: Gaps identified. *Learning Environments Research*, 23(3), pp.269-290.

Raes, A., Vanneste, P., Pieters, M., Windey, I., Van Den Noortgate, W. and Depaepe, F., (2020). Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes. *Computers & Education*, 143, p.103682.

Smith, K.D. (2021), "Is it face time or structure and accountability that matter? Moving from a flipped to a flipped/hybrid classroom", *Journal of Applied Research in Higher Education*, Vol. 13 No. 2, pp. 609-621.

Triantafyllou, E. (2015). The flipped classroom: Design considerations and moodle. In *Using Moodle for supporting flipped classrooms*, Ingeniør Uddannelsernes Pædagogiske Netværk, IUPN, pp. 5-12

Triyason, T., Tassanaviboon, A., and Kanthamanon, P. (2020). Hybrid classroom: Designing for the new normal after COVID-19 pandemic. In *Proceedings of the 11th International Conference on Advances in Information Technology* (pp. 1-8).

Van Wart, M., Ni, A., Rose, L., McWeeney, T., and Worrell, R. (2019). A literature review and model of online teaching effectiveness integrating concerns for learning achievement, student satisfaction, faculty satisfaction, and institutional results. *Pan-Pacific Journal of Business Research*, 10(1), 1-22.

Wiltse, E. C., Gonda, M., Massmann, C., Williams, K., and Bott-Knutson, R. (2020). Assessment of the impact of COVID-19 on honors student learning, institutional connections, and intent to return to campus. *Journal of the European Honors Council*, 4(1), 1-22.

World Health Organization, (2021). *Considerations for implementing and adjusting public health and social measures in the context of COVID-19: interim guidance, 14 June 2021*. WHO/2019-nCoV/Adjusting_PH_measures/2021.1

Young, M.F., Slota, S., Cutter, A.B., Jalette, G., Mullin, G., Lai, B., Simeoni, Z., Tran, M. and Yukhymenko, M., (2012). Our princess is in another castle: A review of trends in serious gaming for education. *Review of educational research*, 82(1), pp.61-89.

Podcasts: A Generator of Non-Formal Learning

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Abstract: The present study examines the relationship between the use of podcasts (mp3 files) as a non-formal learning tool. The study´s epistemological origins lie in Dewey's pragmatism and learning and reflection theory, including the learning approach at University College of Northern Denmark's (UCN) "Reflective Practice-based Learning" (RPL). This paper focuses on how podcasts can increase students' learning and reflection skills by using podcasts as a generator for non-formal learning. The study is based on two different classes that attend an extended course in digital technologies and project management at the Danish University of Applied Science (UCN). The study applies integrated mixed-method data collection: observations, a quantitative survey, and semi-structured interviews. The observations were carried out during four (project management) and seven (digital technologies) full-day lectures in two different classes. These offered an insight into the extent to which the students acquired knowledge by listening to podcasts between classes. The quantitative data consisted of a survey of 65 students, all of whom participated in the courses. The survey was performed as a part of the evaluation at the final course lectures. The semi-structured interviews (ten in all) were used to investigate how the use of podcasts affects students' reflective skills. Ten semi-structured interviews were conducted. The data in this study finds that podcasts/podcasting can have a positive effect on students' non-formal learning in higher education. Established on the findings, there is evidence indicating podcasts as a supplement in higher education can increase students´ motivation toward non-formal learning. The study reveals that podcasts hold the potential to stimulate the student's non-formal learning and increase the students' reflective skills. Based on this evidence, further research is suggested e.g. studies that include an extended investigation on the benefits of students' non-formal learning by using podcasts.

Keywords: podcast, non-formal learning, higher education, reflection, learning media, extended courses

1. Introduction

The use of podcasts in Denmark has increased over the last eight years. The Danish Media Research Centre finds that in 2013 5 % and 2020 29% of the population listened to podcasts every week (Kidde & Niegel, 2021). Listening to podcasts is an activity taking place outside educational settings. A study reveals that most of the listeners listened to the podcasts in their homes or on the go (Ziengs, 2021), for instance on their way to work/school or during other activities (McGarr, 2009). Furthermore, statistics confirm that 40% of the Danish population in 2020 had listed to a podcast through the last three months (Tassy, 2020). 13% of these used podcasts for learning activities for example self-development and languages (Kidde & Niegel, 2021). The present study set out to discover the relationship between podcasts and non-formal learning in higher education, as there is minimal research on how podcasts influence non-formal learning.

Non-formal learning refers to learning through organised activities where learning assistance appears. A frequent cause of non-formal learning could be in-company education, designed online learning like open educational resources, and programmes organised by civil organizations for their members (HIPPE, 2021). Non-formal learning can be used to support formal learning and encourage students and others to develop their knowledge and increase their skills. Normally, non-formal learning is accessible through times when formal learning is not, for example, after the end of the working day and during weekends (Smith, 2022). Andersen & Dau (2021) find that existing research indicates optimism toward podcasting as a learning medium in higher education, supporting more flexible, reflective, and engaging learning environments. Furthermore, Heller (2020) describes how podcasts can offer graduate students in education an informed capability to engage emerging information that will encourage evaluation of improvements in their educative environments. This study sets out to find the relation between the use of podcasts and non-formal learning and focuses on reflection and learning skills.

Throughout this study, the definition of podcasts is produced digital episodes of audio content that are available on the Internet and can be downloaded or streamed on-demand directly on the consumers' media device (Drew, 2017). A podcast can be based on explaining or discussing a particular idea, perhaps as part of a series (Andersen

& Dau, 2021). A podcast is stored on a website, App or another internet location, like a learning management system (LMS). The user can listen to the podcast here or download the podcast to their mobile device (Palenque, 2016).

Though this paper the classification of Podcast and podcasting means an MP3 file that is distributed to the listeners who can listen to the podcast "on the go" (McGarr, 2009).

2. Clarification of the context

The present study was carried out at the University College of Northern Denmark (UCN). It involved an investigation of students enrolled on elective courses as part of a vocational pedagogy diploma and a management diploma: (1) technologies in vocational education (which included seven full-day lectures); and (2) project management (four full-day lectures). Both courses concluded with an oral examination in which students were required to present a synopsis of two pages. Both courses were offered by the UCN department of continuing education, act2learn. The students were employed in full-time jobs and joined the programmes for several reasons (e.g., job requirements, skill development, and general interest). Their educational backgrounds ranged from vocational education and practical experience to master's and PhD degrees. Before attending class, the students were presented with a podcast (located on the LMS) to supplement their reading. The podcasts featured one or two experts discussing a specific topic (Teckchandani & Obstfeld, 2016). The present study focuses on the relationship between podcasts and non-formal learning and discusses whether the former can increase students' learning and reflective skills. Therefore, it is important to define the term reflection as it is understood at UCN.

3. Reflective practice-based learning

The UCN learning approach is called reflective practice-based learning (RPL). Here the principle is the dialectic between theory and practice combined with reflections (Horn, 2020). At UCNs department for continuing education (act2learn), the philosophy of RPL is different from the original philosophy, because the students attending Act2learn are different from the ordinary full-time students, primarily given students' practice experience. The philosophy behind RPL in an Act2learn context is initiated in pragmatism. Brookfield (2000) explains how adult learners distinguish themselves from younger learners by using a dialectical as well as operating on a practical logic. Furthermore, Brookfield (2000) describes how adult learners operate metacognitively and holds the ability to critical reflection. Fundamentally the adult learner addresses an inquiry point of view in relation to their field of practice. This inquiry approach signifies that the new knowledge, the adult learner obtains, is never withdrawn from their field of practice (Elkjær, 2009). As this study sets out to find the relation between the use of podcasts and non-formal with a focus on reflection and learning skills, the above description of reflection and learning will be the core of this study.

4. Podcasts – learning and reflection (state of the art)

A recent study suggests that the benefits of learning and reflection can be achieved by using podcasts (Andersen & Dau, 2021). Based on the definition of non-formal learning where students learn outside a formal learning setting as Smith (2022) describes it, podcasts could lead to learning and reflection. It has previously been observed that by using podcast the students learning ability can be increased, especially podcast with summaries which is useful in learning core content (Almeida-Aguiar, 2016). Furthermore, students can improve their listening skills and vocabulary by listening to podcasts (Gonulal, 2020). Using podcasts for revision of content studies finds that this could lead to deeper learning thus the students involve themselves in the learning process because they are listening to the podcast. In addition, it supports the students' engagement and self-regulation skills (Gachago, et al., 2016). Some studies have suggested that podcasts have the potential to provide students with content-related language and thereby give them a vocabulary they can use in class (Riddell et al., 2020). It has previously been observed that students listening to a podcast can remember examples from the podcast much longer than simple vocabulary terms (Hatfield, 2017). Research has shown that podcasts allow the students to listen while doing activities and that listening to a podcast demands less mental energy than conventional learning layouts (Riddell, et al., 2020). Furthermore, studies of social work have shown that students acquire a deeper critical understanding of theory by listening to podcasts as a supplement to their reading and that they feel better prepared before attending class (Ferrer, 2019 & Andersen, 2018).

Andersen & Dau (2020) highlights how the podcast let students overcome their state of mind and create a language concerning a particular topic which is a crucial ability when reflecting. Accordingly, Almeida-Aguiar

(2016) has demonstrated that when listening to podcasts, students are provided with means to discuss certain subjects during class, which can also minimize doubt and hesitation and help the students understand (Andersen & Dau, 2020). Moreover, student-created podcasts help students relate to their field of practice and not be purely grade-orientated. Studies reported how the process of podcasting creation makes a shift in their thinking about their field of practice (Ferrer, 2019). Moreover, Middleton (2016) states that podcasts can introduce new forms of learning, develop and relocate existing activities, and help when reviewing class activities. Using podcasts students can be inspired to think more deeply on a specific topic (Teckchandani & Obstfeld, 2016). Additionally, Norsworthy and Herndon (2020) discovered that podcasts could be a transformative tool in management education. Researchers have shown that podcasts and podcasting are powerful strong reflective tools for developing engineering students' communication skills (Ballinas-Gonzalez et al., 2020). Furthermore, Hatfield (2017) found that a narrative podcast mixed with a conventional classroom lecture encourages students and increases their confidence. Moreover, narrative podcasts are regarded less omniscient than fact-based lectures since they include fact-based teaching and narrative illustrations (Hatfield, 2017). The flexibility of a podcast makes it possible for students to discover content in new ways and fit their schoolwork into their schedule (Martins et al., 2020). Moreover, students participation is supported by listening to a podcast, and the flexibility offers them the opportunity to relate to the content on-demand (Gachago, et al., 2016).

5. Methodology

The present study used a mixed-method approach to gather quantitative and qualitative data (Cheung, 2019). The mixed-method approach involves using a minimum of two methods, usually quantitative and qualitative (Johnson et al., 2007). This method allows the researcher to gain an in-depth understanding and validation of the topic. Greene (2007) describes how the mixed-method approach is particularly significant in educational research because it offers room for an understanding of the complexity of the subject. The present study includes three data collection methods; semi-structured interviews (face-to-face and online [n = 10] of 15 to 45 minutes duration, a survey (N = 80; n = 65), and participant observation *(*N = 80*;* n = 80).

Semi-structured interviewing revealed the student's lifeworld and obtained insights on how podcasts used as non-formal and informal learning media can improve learning and reflection skills (Kvale & Brinkmann, 2015). The interviews focused on the students' use of podcasts as a medium for non-formal learning. The participant observations were conducted in lectures and the final oral examination. They were documented by field notes taken by one of the researchers. The quantitative data were analysed to establish meaning through condensation. The results were summarised and themes were identified (Brinkmann, 2009). Three detailed schemas with the students' statements were obtained and patterns were detected according to the different data types. The analysis was inspired by the principles of thematic analysis as defined by Clarke and Braun (2013). The thematic analysis generated three main topics.

6. Findings

The findings reveal that podcasts and podcasting played a significant role in non-formal learning. Most of the students participating in the survey find that listening to podcasts results in a better understanding of the topics. Furthermore, the students find that flexibility positively affects their learning and reflection.

The results presented below are organised into the following categories: non-formal learning and learning, non-formal learning and reflection, and the transition from non-formal learning to formal learning.

7. Non-formal learning and learning

The survey found that only four participants did not finish listing to the podcasts which were provided to them. Three of the participants did not find any learning benefits from listening to the podcast and these three participants couldn't use the knowledge presented in the podcast during lectures. However, there was a positive correlation between listening to the podcast and getting learning benefits before attending lectures as approximately 90 % benefited from listing to the podcasts. When asked if they could use the knowledge gained from podcast during the lectures one participant stats "yes, the relationship between what I read, listen to, and do in class is strong," while another said, "I feel well-prepared for class." This corresponds with what Andersen & Dau (2021) find in the relationship between learning and the use of podcasts. Furthermore, these statements suggest that non-formal activities like a podcast can serve as assistance to formal learning and provide an opening for the participants to develop their knowledge and increase their developmental skills (Smith, 2022). In relation to what Smith (2022) describes as non-formal learning one participant claimed that the use of

podcasts "worked as a great appetizer to the different topics and they (podcasts) helped me on track towards the class content" while another explained that "the podcasts gave me some concrete examples of practical elements which supported my transfer from lectures to my one field of practice." These statements showed how podcasts served as a non-formal learning activity that improved the students' learning because they supplemented the formal system (Coombs et al., 1973).

The majority of participants agreed with the statement that listening to podcasts made them feel well-prepared for lectures. Only a few of the respondents (7%) indicated that listening did not give them any advance. There was a positive correlation between listening to podcasts and feeling well-prepared. One participant said that "together with the literature, I felt well-prepared, I thought it was easy to understand what I was reading when I had listened to the podcast first." This indicated that listening to podcasts as a non-formal learning activity can increase students' understanding of a certain topic, as Palenque (2016) also stresses. The participant observation notes revealed that the participants used the arguments and words/vocabulary they had been exposed to in the podcasts during class. This finding is in accordance with Riddell et al (2020) finding in higher education. Riddell et al. (2020) describe the potential podcast give to provide a language and context to the students and give the students a vocabulary they can use during lessons. Just over a quarter of those who answered this question reported that podcast is an excellent supplement to ordinary literature.

A variety of perspectives were expressed when asked what podcasts provided the participants with. One participant states that the use of podcasts "gives a form of "liberty" and good conscience by sitting in the sun and listening", Another participant pointed out that "my motivation was greater because I did not have to sit in front of my PC to learn something." These statements align with the usefulness of making non-formal education accessible when formal education is unavailable, for instance, after college hours or at weekends (Smith, 2022). The informants also indicate a positivity in the flexibility that non-formal learning gives them which parallels to what Andersen & Dau (2021) finds in terms of optimism towards podcast as a learning media in higher education. Heller (2020) describes how podcast provides students in education an informed ability to engage emerging information and will foster evaluation of improvements to be made in their educative environments. One participant argues how podcasts in a non-formal setting gave them a better understanding of project management: "they're a combination of theory and practice, they gave me a realistic understanding of project management; for example, before attending the class, I did not believe that stakeholder analysis was important, but after listening to the podcast I understood its relevance." This statement indicates how podcasts can facilitate students' understanding of particular topics in a non-formal setting.

8. Non-formal learning and reflection

Non-formal learning and reflection seems to be integrated, but how can a podcast generate reflection in a non-formal setting? As mentioned above, the students at act2learn are adult learners taking extended courses. Therefore, reflection might be encouraged by using dialectical as well as practical logic (Brookfield, 2000). The majority of participants (60%) argued that podcasts helped them reflect on their own field of practice and the core content. One participant argued that "listening to podcasts allows me to reflect more when listening than reading." Over two-thirds of those taking the vocational course reported that they were able to reflect on how they could use podcasts in their field of practice. This view was echoed by a participant from the project management class who stated that he reflected on the fact that "project management is a matter of a common language, and project management is about communication." Because adult learners take an inquiry-based point of view of their field of practice, new knowledge the adult learner obtains is never withdrawn from their field of practice (Elkjær, 2009). Therefore, the reflection based on the podcast will always relate to some practice. Non-formal learning provides the opportunity for the students to connect reflection to the field of practice, and it allows the individual to construct knowledge and reflection through their experience, skills, and choices (Smith, 2022), because the non-formal setting is outside the University. When the participants were asked if listening to podcasts strengthened their reflection, 90% confirmed that it did. One stated that "listening to podcasts made me a little wiser and opened a window to the world more than reading." Another participant suggested that podcasts generate reflection because "they provoke additional thoughts and reflections when I combine it with the literature." These statements are aligned with those Brookfield (2000) finds who describe how adult learners operate metacognitively and can be critically reflective. Non-formal learning in the form of podcasts allowed the participants to reflect outside the established formal system; one participant replied to the above question by saying "yes when I combine it with exercise in the forest." In the final part of the survey, the participants were asked if they listened to the podcasts on the go. Forty out of the 65 participants were

listening to the podcast on the go the final part was listening in front of their computer taking notes or in a comfortable place in a non-formal setting. Of the 40 who listened on the go, 22 listened while travelling and the remainder during walks, cleaning, or exercise. These findings illustrate the flexibility and extended access to non-formal learning activities with a positive effect on students' reflective skills.

9. The transition from non-formal learning to formal learning

The current study found that a transition took place during the period when the students used podcasts in a non-formal setting. Over the period the students started to use the content from the podcasts in a formal learning setting. This study discovers two elements of transition. Firstly, the students used content from the podcast in the class activity, secondly, the students used the content from the podcast in their final reports and some cases included the podcasts in their final report. More than two-thirds of the participants confirmed that listing to podcasts provided them with a more in-depth understanding and thereby a firmer foundation for participation in-class activities such as debates. One of the participants described how he normally did not read content before class because it was only repeated in the lectures: "I wanted to listen to the podcasts before attending class because they gave me another dimension and I could use that in-class activities." Another participant explained that "the podcasts helped me to acquire theoretical knowledge and use it in class." This corresponds with Smith´s (2022) findings revealing that non-formal activities can support formal learning. An interviewed participant argued that listening to podcasts provided motivation "there is a dynamic in a podcast you can't get in the literature; it motivates me to better understand the topic." This is in accordance to Andersen & Dau (2021) study confirming that podcasts encourage engagement in different learning environments and Hellers (2020) results that engagement might be improved. Out of the 41 participants joining the technologies in vocational education course, 10 wrote about podcasts in their synopsis and 23 used the podcasts as references. Ten out of the 24 project management students used the podcasts as references in their synopses. This study supports evidence from previous observations by Smith (2022) who finds that non-formal education can serve as a support to formal learning and contribute as an opening for students and other individuals to develop their knowledge and increase their developmental skills.

10. Conclusion, discussion, and future research

The present study aimed to determine the relationship between the use of podcasts and non-formal learning and focused on reflection and learning skills. The results of this investigation illustrate that there to some extent is a positive relation between podcast and non-formal learning. The most important finding from this study is that the participants used podcasts in formal learning situations such as lectures and during their final exams. The data suggest that non-formal activities such as podcast listening can support formal learning and offer an opening for the participants to develop their knowledge and increase their developmental skills at their own pace. The data also suggest that reflection can be fostered by using podcasts in a non-formal setting. Non-formal learning allows students to relate their reflection to their field of practice because it takes place outside the university and allows them to develop their reflective skills through personal experience. The findings contribute to our understanding of how podcasting in a non-formal setting can contribute to learning and reflection and how the knowledge contained therein can be transferred from what is a non-formal activity into formal contexts. A limitation of this study is the relatively small sampling in the quantitative survey which is too small to reveal any significant statistics regarding the topic of this paper. The semi-structured interviews were chosen for the opportunity to add a personalised voice to the quantitative survey and allow the participants to reflect on their experiences. However, one of the researchers was also one of the course lecturers, so there was a risk that their dual role may have influenced the data collection and analysis. However, this was minimised by the presence of another researcher who had no personal knowledge of the participants. In all, the pragmatic nature of the mixed-method approach helped the present authors to understand how podcasts generate reflection and learning in a non-formal setting. To develop a full picture of how podcasts can generate learning and reflection, additional studies is needed including a larger population and longitudinal studies to determent the reflection benefits of using a podcast as a learning media in a non-formal setting. Furthermore, studies, where podcasts function as a part of the curriculum, could be of interest to determine how and if the students benefit from a podcast as a learning media in a formal learning setting. Additionally, studies where podcasts are used in an in-formal learning setting outside structured and formal learning settings, could be of interest.

References

Almeida-Aguiar, C. a. C. A. A., 2016. "Exploring Podcasting in Heredity and Evolution Teaching." Biochemistry and Molecular Biology Education Vol. 26 No. 3, pp. 429-432.

Andersen, R. & Dau, S., 2020. The Potential of Podcasts as a Learning Medium in Higher Education. 19th European Conference on e-Learning ECEL 2020, 28 10, pp. 16-22.

Andersen, R. D. S. N., 2018. Podcast as a Learning Media in Higher Education. The 17th European Conference on E-Learning, 01 11, pp. 424-430.

Andersen, R. H. & Dau, S., 2021. A Review of Podcasts as a Learning Medium in Higher Education. Proceedings of the 20th European Conference on e-Learning ECEL 2021, 28 10, pp. 34-42.

Ballinas-Gonzalez, R., Sanchez, B., Rodriguez-Paz, M. & Nolazco-Flores, J., 2020. "How the Use of an Internet Radio Program and Podcast Helped Civil Engineering Students Engage With Local Communities in Need." ASEE Virtual Annual Conference Content Access, Virtual On line, 06.

Brinkmann, S. K., 2009. Interview Introduktion til en håndværk. 1 red. København : Hans Reitzels Forlag, København.

Brookfield, S., 2000. Adult cognition as a dimension of lifelong learning. I: M. L. John Field, red. Lifelong Learning Education Across the Lifespan. 1st Edition red. London: Routledge, p. 13.

Clarke, V. &. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. The Psychologist, 26(2), pp. 120-123.

Cheung, C. P., 2019. Towards Holistic Supporting of Play-Based Learning Implementation in Kindergartens: A Mixed Method Study.. Early Childhood Education Journal, Springer, 47(5), 4 6, pp. 627-640.

Coombs, P., Prosser, R. & Ahmed, M., 1973. New Paths to Learning. New, International Council for Educational Development/UNICEF.

Drew, C., 2017. Edutaining audio: an exploration of education podcast design possibilities. Educational Media International, 15 April , pp. 48-62.

Elkjær, B., 2009. Pragmatism: A learning theory for the future. I: K. Illeris, red. Contemporary Theories of Learning: Learning Theorists -- In Their Own Words. London: Routledge, pp. 74-89.

Ferrer, I. L. L. a. S. J. (., 2019. Podcasting for Social Justice: Exploring the Potential of Experiential and Transformative Teaching and Learning Through Social Work Podcasts. Social Work Education, Vol. 21, No. 10, 10 10, pp. 849-865.

Gachago, D., Livingston, C. & Ivala, E., 2016. Podcasts: A Technology for All?. British Journal of Educational Technology, Vol. 47, No. 5,, 08 07, pp. 859–872.

Gonulal, T., 2020. "Improving Listening Skills With Extensive Listening Using Podcasts and Vodcasts." International Journal of Contemporary Educational Research, Vol. 7, No. 1, 15 06, pp. 311-320.

Greene, J. C., 2007. The generative potential of mixed methods inquiry. International Journal of Research & Method in Education, 25 02, pp. 207-211.

Hatfield, E., 2017. Narrative Learning Using Podcasts in Interpersonal Communication. Communication Teacher, 09 10, pp. 236-242.

Heim, Ashley, A. & B Holt, E., 2021. Describing Informal Learning Experiences among College-age Adults. Journal of STEM Outreach 4 (1), 27 5, pp. 1–10.

Heller, M., 2020. "Podcasts as Informal Learning Tools: Graduate Students' Experiences With Podcasts as Self-Directed Learning", Florida : Electronic Theses and Dissertations, 2020-. 362.

HIPPE, R., 2021. SELFIE, adult learning and non-formal learning, Luxemborg: Publications Office of the European Union.

Horn, L. H. (. W. p. o. R.-P. B. L., 2020. www.ucn.dk. [Online] Available at: https://blad.ucn.dk/white-paper-on-rpl/#/ [Senest hentet eller vist den 10 03 2022].

Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. A., 2007. Toward a Definition of Mixed Methods Research. Journal of Mixed Methods Research, vol 1, issue 2, 1 4, pp. 112-133.

Kidde, R. & Niegel, P., 2021. dr.dk. [Online] Available at: https://www.dr.dk/om-dr/fakta-om-dr/medieforskning/medieudviklingen/2020/det-private-massemedie [Senest hentet eller vist den 16 02 2022].

Kvale, S. & Brinkmann, S., 2015. Interview: det kvalitative forskningsinterview som håndværk. 1 red. København: Hans Rietzels Forlag.

Martins, A., Gomes, D. & Quintana, A., 2020. Factors Enabling the Acceptance and Use of a Podcast Aggregator in Accounting Education. Education and Information Technologies, Vol. 26, No. 5, pp. 5427–5449.

McGarr, O., 2009. A review of podcasting in higher education: Its influence on the traditional lecture. Australasian Journal of Educational Technology, 309-321.

Middleton, A., 2016. Reconsidering the Role of Recorded Audio as a Rich, Flexible and Engaging Learning Space. Research in Learning Technology, Vol. 24, No. 5, 16 12, pp. 1-13.

Norsworthy, C. & Herndon, K., 2020. Leading by Ear: Podcasting as an Educational Leadership Tool. Journal of Leadership Education, Vol. 19, No. 3 , p. 7.

Palenque, S. M., 2016. The Power of Podcasting: Perspectives on Pedagogy. Journal of Instructional Research, v5 , pp. 4-7.

Riddell, J. M. et al., 2020. Independent and Interwoven: A Qualitative Exploration of Residents' Experiences With Educational Podcasts. Academic Medicine, Vol. 95, No.1, 01 01, pp. 89-96.

Smith, A., 2022. COVID-19 and Informal Education: Considerations for Informal Learning During the Pandemic. The International Journal of Multidisciplinary Perspectives in Higher Education, 15 02, pp. 122-127.

Tassy, A. a. N. M. B., 2020. It-anvendelse i befolkningen, København: Danmarks Statistik.

Teckchandani, A. & Obstfeld, D., 2016. Storytelling at Its Best: Using the StartUp Podcast in the Classroom. Management Teaching Review, Vol. 2, No. 1, 12 10, pp. 26-34.

Ziengs, E., 2021. Podcaststats.dk. [Online] Available at: https://www.podcaststats.dk/ [Senest hentet eller vist den 15 4 2021].

Motivational Challenges of Engineers Participating in an Online Upskilling Program

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Abstract: The present powerful surge of available online learning platforms will provide employees with enhanced opportunities to rapidly develop their skills, regardless of time and place. Despite the potential, there are challenges for participants on online learning platforms to finalise the courses they engage in. The reasons for the high number of students dropping out before completion of the course are motivational, social, and technological. Studies show that large skill gaps exist among industry employees worldwide. It is often caused by the implementation of new technologies, digitalization, as well as increasing requirements on sustainability and resilience. E-learning provides a major opportunity to bridge such skill gaps. Thus, the flexibility offered by online learning platforms can be of high value for upskilling of industrial employees. This paper describes a study on the skills and learning processes of engineers in industry, participating in a national Swedish upskilling programme. The programme offers online learning modules, provided by 13 collaborating Swedish universities. The paper proposes a method for understanding underlying challenges in the participants' motivation and their module completion rates. The questionnaire "HowULearn", developed by Helsinki University, has been previously validated at several universities, consistently delivering a valuable understanding of student learning and motivation. To accommodate the methodological needs of this study, the questionnaire was adapted for an industrial context, investigating motivational challenges of learners on the Ingenjör4.0 platform. The primary outcome of the study is a framework for analysing learner challenges related to motivation within e-learning contexts. Further, this paper suggests a way of utilising the HowULearn questionnaire for participants on the Ingenjör4.0 online learning platform, to understand their challenges. The adapted questionnaire was tested with participants of the platform (22 respondents) and the results were analysed by identifying participant challenges. The outcome and conclusions of this study will improve the Ingenjör4.0 online learning platform but can also be used generically, to improve other e-learning environments.

Keywords: e-learning, online learning platform, motivation, upskilling, industry, engineering

1. Introduction

European Industry is experiencing tremendous changes due to trends like sustainability policies, requirements on resilience and digitalization, and ageing populations. The authors claim that humans are key in the transition towards a sustainable and resilient European industry. These humans are the ones needed to create innovative solutions for overcoming the present challenges faced by the industry. For a long time, the focus has been on improving efficiency and productivity, as supported by the Industry 4.0 approach (Kagermann, Lukas, Wahlster, 2011). To complement this approach, the European Commission recently launched the concept "Industry 5.0", bringing sustainable, resilient, and human-centric solutions into focus, and putting advanced upskilling on the agenda (Breque, de Nul, Petridis, 2021). The rapid transformation results in a huge need for upskilling among industry employees. The increase in online learning opportunities for industry employees shows the reaction of learning suppliers to this need. Industry employees face different challenges in their learning, as compared to regular university students. These people have to use time outside work to upskill, while often having families and other obligations.

One such emerging upskilling platform is Ingenjör4.0, created by 13 collaborating universities in Sweden. The platform consists of 15 modules with lectures, live webinars, reflectional exercises, and quizzes. The platform is used by employees from a range of small to large sized companies, giving engineers a flexible solution to acquire new skills. Even though feedback from Ingenjör4.0 participants is positive, challenges remain. An important question to ask in the light of the strong need for upskilling is what challenges and opportunities the participants of e-learning platforms face. This study aims to better understand such challenges and opportunities of the participants in the Ingenjör4.0 platform. For future life-long and life-wide learning, it is

crucial to identify why some participants are doing good, while some are not, eventually risking dropping out of the learning journey.

2. Theoretical background

According to the World Economic Forum (2020), 50% of the global workforce will need reskilling or upskilling until 2025. This means they will learn new skills, to be eligible for work in many different and future tasks. In their report, the World Economic Forum also lists top skills that are crucial for the future workforce. These skills include analytical thinking and innovation, active learning, complex problem-solving, creativity, leadership and social influence, technology use, technology design, programming, resilience, flexibility, emotional intelligence, service orientation, negotiation, and more (World Economic Forum, 2020). Since the industry is changing faster than ever, there is a special need for industrial digitalization, also described as industry 4.0. Therefore, industry employees need new ways to acquire new skills.

The use of different online learning platforms has increased and the variation of platforms used has grown rapidly. E-learning provides opportunities to study remotely, at your own pace, when not tied to a specific place and time. Creating e-learning platforms requires an understanding of learners and their specific needs (Hills, 2003). As Howard Hills (2003) notes, learners use the learning materials differently depending on their "personality, preferences for learning styles, attitudes to others in the workplace, what is considered acceptable locally, fluency of web familiarity, keyboard dexterity, command of literacy and numeracy". Students' experience, background, interactions and autonomy are linked to student satisfaction in online learning platforms (Abuhassna et al., 2020). Massive Open Online Courses (MOOCs) have become more popular, posing a way to learn something quite quick with easy and free access. However, below 13% of MOOC participants complete the course they signed up for (Onah, Sinclair, Boyatt, 2014).

For self-motivated learners, e-learning may often suit well. But it can also cause motivational challenges to learners (Hills, 2003). Interaction in online learning platforms may be impersonal and it may not support a sense of community, some technical problems may occur and understanding the course objectives may be challenging (Song et al., 2004). Research among university students shows that as support and feedback generally play a role in motivation and learning, instructional support, technical support and peer support also play important roles in course satisfaction within e-learning environments (Lee et al., 2011; Paechter, Maier, Macher, 2010). Instructional support contains clear instructions and guidance during the learning process, correcting and giving constructive feedback to learners. Peer support and collaborative, interactive work are important aspects of learning, also in e-learning platforms where students are often working remotely alone. Familiarity with technology and e-learning platforms, and sufficient technical support help to prevent inconvenience with online learning (Lee et al., 2011). According to Hattie and Timperley (2007), effective and powerful feedback should answer three questions for students; "Where am I going?", "How am I going?" and "Where to next?", and these questions could be made at four levels: task level, process level, self-regulation and self-level (Hattie & Timperley, 2007).

Students have different backgrounds and learning experiences and they also have different approaches to learning. Study approaches are linked to the student's experiences and academic competencies (Entwistle, 2009; Asikainen et al., 2022). The Deep approach refers to seeking a deep understanding of things to be learned, checking the evidence, arguing and being interested in the course content. An organised approach refers to the management of own study schedule and effort. The surface approach refers to storing information that is required in a course without deeper reflection and difficulties in making sense of the content (Entwistle and McCune, 2004; Entwistle, 2009). By understanding the learner's behaviour, needs, motivations and challenges, platforms supporting deep learning can be designed, giving the most appropriate support to them.

Any student's approach toward learning may affect her or his well-being (Asikainen et al., 2020). Student experiences of well-being, feelings about workload, and attitudes toward learning can be approached through the concept of burnout (Salmela-Aro et al., 2009; Salmela-Aro and Read, 2018). The concept of burnout consists of three different dimensions; exhaustion, cynicism and inadequacy. Feelings of exhaustion arise from a high perceived workload in studies and overall fatigue. Cynicism refers to a cynical attitude towards studies and feelings of a loss of interest or meaning in studies. Feelings of inadequacy may arise from reduced beliefs of competence or achievement (Salmela-Aro et al., 2009; Salmela-Aro and Read, 2018).

3. Method

Student experiences will be gathered through the HowULearn questionnaire (Parpala and Linblom-Ylänne, 2012). The questionnaire has been validated and widely used in Finnish and international contexts (Parpala et al., 2021). The HowULearn questionnaire contains different parts/question patterns that measure student experiences and opinions about their studies and studying environment, learning styles, self-efficacy, burnout and general working life competencies. Respondents answer each item on a 5-point Likert scale (1 = totally disagree, 5 = totally agree). The original questionnaire for university students has been slightly modified to make it more suitable for engineers working in the industry, and specifically for the e-learning environment by omitting some questions concerning learning materials. The authors also excluded questions related to self-efficacy beliefs because the questionnaire was sent to participants after they may have finished their studies in modules already.

The HowULearn questionnaire consists of different parts, measuring various aspects of student experiences.
In this research, participants answered some background questions (age, gender, modules that they took part in, module performance rate and job role) and four different parts concerning their learning. These parts indicate learning approaches; experiences about organisation and structure, relevance and support, feedback; burnout; and working life competencies. Questions about learning approaches (12 items) are originally from the Approaches to Learning and Studying Inventory (Entwistle and McCune, 2004).

The question pattern about burnout contains 9 items that measure students' exhaustion (4 items), cynicism (3 items), and inadequacy (2 items) in their studies. Questions about burnout are based on Study Burnout Inventory (SBI-9) by Salmela-Aro et al. (2009). In the same way, the other parts of the questionnaire contain several items that belong together and form an answer to a dimension.

Our object of analysis is engineers in Sweden that take part in the Ingenjör4.0 upskilling modules. The participants have decided by themselves to take modules through the program. The survey was sent out to 100 participants of the Ingenjör4.0 platform that took part in modules during spring 2022. 22 people were responding to the survey, of which 32% were female and 68% male. The respondents' age ranges from 21-60 years, whereof 28% are 21-30 years old, 27% 31-40 years old, 36% 41-50 years old, and 9% 51-60 years old. 82% of the respondents had finished 80%-100% of the module that they were enrolled in. None of the respondents had only completed 0-20% of the module, and 18% had finished between 21%-80% of the module. The respondents work within the following job areas: Sustainability, Production engineering, Product management, R&D, Technical support, Development engineering, Design engineering, Sales, Structural analysis engineering, Digitalization, and Management. The respondents were enrolled in the modules additive manufacturing, management and manufacturing digitalization, smart products and industrial internet of things, standards and interoperability in the digitised industry, and sustainable production systems.

The results of the survey are analysed by visualising histograms of the participants' answers about the different dimensions that are addressed in the survey, using a script in RStudio. The survey items are summarised into mean variables, e.g. burnout, and the script creates histograms for these means. Mean variables are formed based on each subscale of the questionnaire (study approaches, organisation and structure, relevance and support, burnout and working life competencies). Furthermore, Pearson correlations between different variables are calculated and further inspected with scatterplots. Since the sample size is too small to take tests of significance into account, correlation coefficients rather function as an indicator for associations within the sample.

4. Results

The challenges and opportunities that could be identified by the survey are presented in the following part, structured identically to the survey itself, and divided into different topics.

4.1 Study approach

The first part of the survey showed that most of the respondents put a lot of effort into their studies, that they work organised in their studies, and that they try to relate the new material to prior knowledge. This indicates that most of the respondents have a deep learning approach or an organised approach. 23% of respondents

don't think they organise their study time carefully to make the best use of it, and also 23% of respondents think they don't prioritise their time carefully to fit everything in.

4.2 Organisation and structure

Even though 59% of the respondents find it clear what they are expected to learn in the modules, 18% don't. Further, 68% of the respondents think what they are taught matches what they are supposed to learn, while 13,6% of them don't think it matches.

4.3 Relevance and support

91% of respondents can see the relevance of what they were taught, and 77% found most of what they learned interesting. 73% of respondents enjoyed participating in the module. The answers about support from other students were more spread out. Even though most participants say they can work comfortably with other students, 36% of the respondents don't think that students support each other or help when it is needed.

4.4 Feedback

31% of the respondents think that they don't get enough feedback about their learning, while 23% think they do get enough feedback. 32% of respondents think that the feedback given helps them to improve their ways of studying, while 32% of respondents don't think so. 41% of respondents think that the feedback given helps them to clarify things they hadn't fully understood, while 36% don't think so.

4.5 Mental wellbeing

In this part, cynicism, inadequacy and exhaustion are measured. Regarding cynicism, 13,6% of respondents lack study motivation and often think of giving up, while 78% of respondents don't. 13,6% of respondents are continually wondering if their studies have any meaning, while 73% of respondents don't agree with this statement. 13,6% of respondents feel inadequate in their studies, while 59% of respondents don't have this feeling of inadequacy. When it comes to exhaustion, 74% of respondents don't feel overwhelmed by the work related to their studies. Still, 4,6% of respondents do feel overwhelmed. None of the respondents answered that they sleep badly because of the studies. On the other hand, 13,6% of respondents worry about things related to their studies during their free time, but 63,7% don't. None of the respondents answered that the pressure of their studies causes problems in their close relationships with others.

4.6 Working life competencies

This part of the survey gives insights on how well respondents think they can apply their gained knowledge in their working life and about their collaboration and communication with other students. 68% of respondents say they have learned to apply theoretical knowledge to practice. 64% of respondents think that they have learned to see things from different points of view. On the other hand, only 27,3% of respondents think that they have learned to solve problems in practical situations and only 40,9% of respondents think that they have learned to make arguments for their thoughts. When it comes to collaboration with other students, only 31,8% of respondents think that the experience in Ingenjör4.0 has developed their collaboration skills and only 13,6% of respondents think that they could develop their skills in acting as a group member.

4.7 Correlations

There is a correlation between respondents' answers on applying the competencies that they acquired in their working life with what they answered on feedback. There is a tendency that respondents who think that there was satisfying feedback given also think that they can better use the acquired knowledge in their work life. A similar tendency can also be seen in the correlation between feedback and collaboration skills.

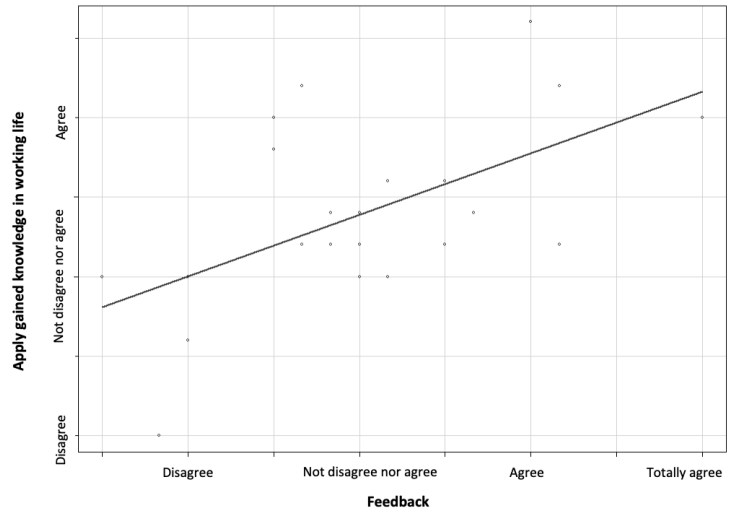

Figure 1: Correlation between respondents' answers on feedback and application of gained knowledge in working life

There is a negative correlation between the respondents' answers about the feeling of support among learners and their answers about study burnout. This means that most of the respondents that answered that they felt support from other learners didn't feel any study burnout.

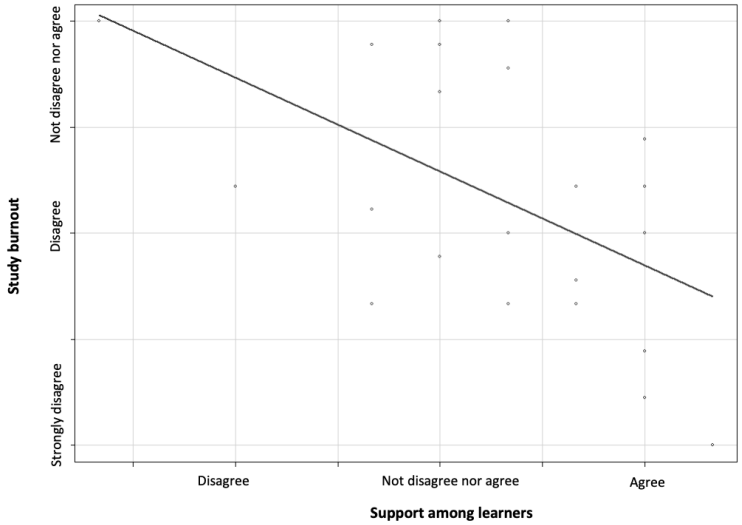

Figure 2: Correlation between respondents' answers on support among learners and study burnout

5. Discussion

The survey results show that the respondents face different challenges while using the online learning platform. These challenges are feedback that is given through the e-learning platform, a lack of collaboration and support among learners, and some small amount of study burnout. The respondents experience very well the relevance of the modules, and the application of gained knowledge in their work-life, and most of them have a deep study approach.

This study's findings have to be viewed in light of the following limitations. Firstly, the sample was quite small, which makes it impossible to draw significant conclusions. The insights from the data can only give implications and further studies are needed. Thus, more data from a bigger sample is necessary to make the research transferable. Secondly, the validity of the HowULearn questionnaire has been proven before, but for university students. In this study, the population consists of engineers working in companies that do these studies besides their normal work-life. The question that arises is if the proven method still provides valid results in the context of people who are in another stage of their life than university students. As an example, employees have another focus in life than university students, which needs to be taken into consideration

when asking questions about wellbeing and burnout. Since the question was put in a way that asked about the participant's stress related to their studies, the stress in other parts of their life maybe wasn't taken into account even though it could be an important factor to understand how a person prioritises parts of their life. Further, in this study, the participants are taking only one module, which means they naturally spend less time on studies as university students.

Still, the results of the HowULearn questionnaire give indications of the learner's experience and further studies should be conducted to allow transferability. More data is needed to identify an actual correlation between for example completion of the module and the different dimensions, such as feedback, burnout, and study approach.

However, this study also has several strengths. First of all, the study has proven that the questionnaire can be used in this context to find out how participants of this e-learning platform experience their learning. Secondly, the questionnaire enables the systematic analysis of the participant's learning experience and pinpoints relevant dimensions that need to be understood to increase the rate of completion of the module. Further, the study can be scaled up in the future to gain statistical significance.

At this point, the results can be used to discuss how the challenges that these learners face can be tackled. One of the challenges is the lack of received feedback. It seems like a challenge to give feedback to each learner in a sufficient way through an e-learning platform. One question to look into further is how feedback could be given by a machine in the platform and if that would be satisfying for the learner. As mentioned before, when giving feedback it is important to include 1) Where am I, 2) Where do I want to go?, and 3) How do I get there? (Hattie). If a machine or a human could ask these questions and support the learner in answering them, the feedback could be given automatically. Another challenge that the learner faces is the collaboration with other participants on the platform. The implementation of collaboration and support spaces for the learners could be discussed in the future.

6. Conclusion

The industry is experiencing a huge transformation that leads to massive needs for upskilling of the workforce. E-learning platforms play an important role since they offer employees a flexible way to learn new skills. However, there remain challenges for those using e-learning platforms. This study has been focused on an e-learning platform for engineers, created by 13 collaborating universities in Sweden. Challenges and opportunities of the learners have been identified by sending out a questionnaire to participants of modules of the e-learning platform, addressing the learning dimensions - study approach, organisation and structure, relevance and support, feedback, mental wellbeing, and working life competencies. The challenges that the 22 respondents of the survey face are the lack of satisfying feedback, a lack of collaboration and support among learners, and in some smaller amounts the feeling of study burnout. On the positive side, most of the respondents have a deep study approach, think that what they learn is relevant, and can apply the gained knowledge from the platform in their work life. The identified challenges create opportunities to improve the learning experience for the participants of the e-learning platform.

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References

Abuhassna, H., Al-Rahmi, W. M., Yahya, N., Zakaria, M. A. Z. M., Kosnin, A. B. M. and Darwish, M. (2020) *Development of a new model on utilizing online learning platforms to improve students' academic achievements and satisfaction.* International Journal of Educational Technology in Higher Education, 17(1), 1-23. https://doi.org/10.1186/s41239-020-00216-z.

Asikainen, H., Salmela-Aro, K., Parpala, A. and Katajavuori, N. (2020) *Learning profiles and their relation to study-related burnout and academic achievement among university students,* Learning and Individual Differences, 78. DOI: https://doi.org/10.1016/j.lindif.2019.101781.

Bawa P. (2016) *Retention in Online Courses: Exploring Issues and Solutions—A Literature Review,* SAGE Open, doi:10.1177/2158244015621777.

Breque, M. , de Nul, L., Petridis, A. (2021) *Industry 5.0 - Towards a sustainable, human-centric and resilient European industry,* Policy brief European Commission.

Entwistle, N. and McCune, V. (2004) *The Conceptual Bases of Study Strategy Inventories,* Educational Psychology Review, 16, pp. 325-345. 10.1007/s10648-004-0003-0.

Entwistle, N. (2009) *Teaching for Understanding at University: Deep Approaches and Distinctive Ways of Thinking,* Basingstock: Palgrave Macmillan.

Hattie, J. and Timperley, H. (2007) *The Power of Feedback,* Review of Educational Research, 77(1), 81-112, DOI:10.3102/003465430298487.

Hills, H (2003) *Individual Preferences in E-Learning*, Taylor & Francis Group, ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/jyvaskyla-ebooks/detail.action?docID=3002202.

Kagermann, H., Lukas, W. D., Wahlster, W. (2011) *Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. industriellen Revolution,* VDI Nachrichten, 13.1, 2-3.

Lee, S.J., Srinivasan, S., Trail, T., Lewis, D and Lopez, S. (2011) *Examining the relationship among student perception of support, course satisfaction, and learning outcomes in online learning*, The Internet and Higher Education, 14(3), 158-163, https://doi.org/10.1016/j.iheduc.2011.04.001.

Onah, D., Sinclair, J. and Boyatt, R. (2014) *Dropout Rates of Massive Open Online Courses: Behavioural Patterns*, 6th International Conference on Education and New Learning Technologies, DOI:10.13140/RG.2.1.2402.0009.

Paechter, M., Maier, B. and Macher, D. (2010) *Students' Expectations of and Experiences in ELearning: Their Relation to Learning Achievements and Course Satisfaction.* Computers & Education, 54, 222-229, https://doi.org/10.1016/j.compedu.2009.08.005.

Parpala, A., and Lindblom-Ylänne, S. (2012) *Using a research instrument for developing quality at the university,* Quality in Higher Education, 18, 3, pp. 313–328.

Parpala, A., Mattsson, M., Herrmann, K.J., Bager-Elsborg, A., and Hailikari, T. (2021) *Detecting the Variability in Student Learning in Different Disciplines—A Person-Oriented Approach,* Scandinavian Journal of Educational Research, DOI:https://doi.org/10.1080/00313831.2021.1958256.

Salmela-Aro, K., Kiuru, N., Leskinen, E., and Nurmi, J.-E. (2009) *School Burnout Inventory (SBI): Reliability and validity,* European Journal of Psychological Assessment, 25, 1, pp. 48–57, DOI: https://doi-org.ezproxy.jyu.fi/10.1027/1015-5759.25.1.48.

Salmela-Aro, K., and Read, S. (2017) *Study engagement and burnout profiles among Finnish higher education students*, Burnout Research, 7, pp. 21-28, DOI:https://doi.org/10.1016/j.burn.2017.11.001.

Song, L., Singleton, E.S., Hill, J.R. and Koh, M.H. (2004) *Improving online learning: Student perceptions of useful and challenging characteristics,* Internet and Higher Education, 7(1), 59-70, Elsevier Ltd. https://doi.org/10.1016/j.iheduc.2003.11.003.

World Economic Forum (2020) *Future of Jobs Report*, https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf

The Global Case Study Challenge: A Virtual Exchange Developing Global Work Competencies

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Abstract: The Global Case Study Challenge (GCSC) is a virtual exchange program designed for Bachelor and Master level students from interdisciplinary programs. The program focuses on the development of key Global Work (GloW) competencies, defined as: intercultural, digital communication and sustainability competencies. This paper discusses how the GCSC, as a new virtual model of teaching and learning, in a real-world context, supports the development of future-oriented work competencies. These competencies are crucial for effective global virtual teamwork and New Work scenarios in remote contexts. To date, 1450 students and 50 educators from 30 universities across 20 different countries have worked together in some 380 Global Virtual Teams on real-life business cases. The learning design of this virtual exchange project is rooted in the knowledge that future-oriented global work competencies such as intercultural competence, digital communication competence and sustainability competence can only be developed through transformative learner-centred experiential learning. In the 2021 iteration of the GCSC, over the 8-weeks of the program, 86 groups of interdisciplinary Global Virtual Teams (GVTs) worked together: Establishing team-building dynamics while working in self-directed GVTs of 5-7 students, reflecting on (corporate) sustainability, collaborating on real-life business cases, and presenting their solutions and recommendations to a major global corporate partner at a virtual conference. The impact of the program on students' competency development was measured using a longitudinal study design. The intercultural, digital communication, and sustainability competencies of the participants were measured pre-exchange (n=263) and post-exchange (n=274). The findings demonstrate a consistent increase of competencies over time among the program participants in almost all categories (knowledge, skills, attitudes), providing clear evidence of the overall positive impact of the GCSC on participants' competency development over the two-month program. Ultimately, the GCSC contributes towards students becoming highly effective members and leaders of high-performing Global Virtual Teams.

Keywords: virtual exchange, e-learning design, collaborative e-learning, future work competencies, experiential virtual learning environment, internationalization

1. Background

The GCSC represents an innovative and high-impact career-oriented teaching and learning virtual exchange (VE) project, which provides educators and students with first-hand intercultural and international experience. The Global Case Study Challenge (GCSC) is a multidimensional VE incorporating both professional development for educators and learning and competency development for students. The 2021 iteration was a collaboration of 18 universities from across the globe - from Austria, Spain, to Japan, Russia, Malaysia and Chile - with the specific aim of enhancing Global Work (GloW) competencies: digital communication, intercultural and sustainability competencies. The program has grown exponentially since its first iteration, in 2018, when 3 universities from Austria and Chile took part with a total of 90 students. By its fourth iteration in 2021, a total of 1450 students and 50 educators from 30 universities across 20 different countries have participated in 380 Global Virtual Teams (GVTs). Collaborating as an intercultural, interdisciplinary, virtual team itself, the GCSC management team draws on extensive research, teaching and training expertise in: International Education; Virtual Exchange (VE)/Cooperative Online International Learning (COIL); Intercultural Management; Corporate Sustainability; Project Management; New Work; International HRM; as well as inspirational events design and management (Covarrubias-Venegas et al., 2021).

The GCSC, as a virtual exchange, has been developed in alignment with national and international HEI strategies, and provides a specific methodology for the internationalization of curricula, helping to further in particular Internationalization at Home (IaH) and virtual mobility strategies. IAH and the internationalization of university curricula have been receiving significant attention recently at higher education institutes (Rubin, 2017). Online international activities are promoted by many institutions as an important means of IaH and increasingly also as

part of responsible internationalization, as universities strive to find ways to foster student and staff exchanges and international experiences when physical mobility is not possible or desirable. Rubin (2017) suggests that student mobility reaches less than 10% of students in the US and Western Europe, while for the rest of the world the figure is closer to 1% (p.31). These figures are likely to have increased following the COVID-pandemic, but nonetheless provide a clear indication of the need for an increased drive towards virtual mobility as a means of increasing international collaboration. Virtual exchange programs are considered to make a valuable contribution to international, national, and institutional agendas for more accessible and inclusive forms of learning for all students. The GCSC has been purposefully designed as a sustainable form of VE, contributing to responsible internationalization. This is particularly important in times where internationalization and cross-border mobility are considered as only accessible to those individuals who can afford it. This global virtual cooperation format is intentionally equitable and accessible to those individuals unable to go on exchange. As such, the GCSC makes international, intercultural, and interdisciplinary experiences possible for those who have a personal, financial, or family situation that hinders physical mobility. As a VE/COIL initiative, the GCSC provides invaluable opportunities for intercultural and interdisciplinary exchange, the forging of new global connections through technology-mediated interaction, and life-enriching authentic international experiences that enhance student engagement (Buko et al., 2021).

The compact and career-oriented design of the GCSC means that it is adaptable across disciplines and departments and can be used as an independent virtual exchange program or as an integrated part of a course or module as with Global Networked Learning (GNL). While traditional COIL projects involve co-developing and co-teaching complete for-credit courses, the GCSC can also be incorporated as a collaborative component for just one part of a course or module or can be run as a stand-alone elective course. This can help educational partner institutions design individual curriculum and learning outcomes, making GCSC outcomes more responsive to the future of work. Individual meetings are held with educators and institutional representatives in advance of participation in the GCSC to insure interoperability between the GCSC and the participating educational contexts.

This paper refers specifically to the fourth iteration of the GCSC in 2021, in which a sustainability focus was added as the third key component of the Global Work competencies model, in addition to intercultural communication competencies and digital competencies. The authors of this paper hold that sustainability thinking should be considered as a key future-oriented global work competency. The GCSC program aims for both students and educators to increase their knowledge and awareness of sustainability in general and specifically in the corporate context. The project-based learning design revolves around five real business case studies which students work on. In the 2021 iteration, the cases were written in collaboration with a global corporate partner about five different aspects of a major international Merger and Acquisition (M&A) involving a Spanish and Japanese multinational. This paper discusses the Global Case Study Challenge as a highly effective virtual exchange for developing much sought-after global work competencies.

2. Global Work (GloW) competencies

Today's post-pandemic context, with a vastly increased number of people working remotely in virtual teams and virtual contexts, means that a new set of competencies are needed, tailored specifically to the context of the virtual workspace. As a result of fast-changing and uncertain work environments, companies are re-envisioning their workplaces and processes in response to new challenges and opportunities.

2.1 Flexibility and virtuality in New Work environments

The increase in virtual work environments means that teams can work more flexibly and, by traveling less, are also becoming greener (Olaisen and Revang, 2017). Most working environments involve some degree of virtuality and collaboration. Graduates entering the labour market are thus finding increased work opportunities in remote or partly remote (hybrid) work contexts with highly diverse teams. These new 'workscapes' are becoming increasingly culturally complex and ubiquitous work settings, shaped by global and local forces and tensions. Gibson and Grushina (2021), for example, have noted the need for new strategies that "address nuances of global teamwork, intricate dynamic needs of team members, and deep-seated assumptions and their associated challenges, such as intercultural conflicts and difficulties managing technology preferences" (p.1). These new strategies include identity-building, cultural-bridging, conflict management and being able to establish an effective set of technological repertoires.

Higher Educational Institutions (HEIs) are responsible for fostering students' learning to develop the skills and competencies they need to effectively contribute to both the future of work and the future of humanity. These competencies urgently need to be re-evaluated and realigned with New Work scenarios and the reality of working in partly or fully virtual contexts. This includes helping students develop competencies relating to self-awareness, intercultural communication and specifically the intercultural dynamics of virtual teams, conflict management, digital communication competencies, as well as an ability to effectively align technological preferences and create technological repertoires for virtual teamwork.

2.2 Role of HEI in competency development for virtual teamwork

As global virtual teamwork and remote work are on the rise, and were even before the COVID-19 pandemic, HEIs are required to provide the framework for graduates to effectively perform in fully virtual or partly virtual environments. Today, most people are not sufficiently prepared for work in virtual environments (Kolm et al, 2021). Nandigama (2021), suggests that virtual teams as part of international online collaborations (IOCs) show a trend of participants lacking the competencies to fully participate in IOCs. Much literature on virtual teams in a work context continues to suggest that cultural and temporal misunderstandings are commonplace and a result of the geographical dispersion of teams. (Shen, Lyytinen, and Yoo, 2015; Tenzer, Pudelko, and Harzing, 2014; and Muszyńska, 2021). This makes working effectively in virtual teams a significant challenge. While many students are technologically competent, particularly digital natives, there are several studies that indicate that they do not have the competencies necessary for effective virtual collaboration (Clearly et al., 2019). This points to digital natives having basic office and email skills, social media and internet use but lacking the competencies to apply these effectively in virtual teamwork settings. The virtual context is increasingly culturally and contextually complex and poses additional challenges relating to communication, use of technology, leadership, project management and cultural dynamics (Clearly et al., 2019).

HEIs urgently need to re-think and re-design their teaching, learning and research environments to equip students with critical Global Work (GloW) competencies. The authors of this paper, as learning architects of the Global Case Study Challenge, define core Global Work competencies as: intercultural competency, digital communication competency and sustainability competency. These are understood as a set of future-oriented transversal competencies, essential to the future of work but also the future of international collaboration.

2.3 Virtual exchange as a platform for honing New Work competencies

VE/COIL programs often explicitly aim to develop intercultural competencies, and some focus on International Online Collaboration Competencies (IOCC). Kolm et al. (2021), based on a literature review of some 516 studies, found only 14 empirical studies providing evidence for IOCC development in Higher Education and identified six kex competency domains of IOCCs: 1. ICT; 2. Intercultural and cultural; 3. Communication and language; 4. Self-management and organization; 5. Collaboration; and 6. Domain-specific (depending on the profession or learning domain, such as collaborative learning using a wiki). The IOCC competencies listed here are all embedded in the Global Case Study Challenge design. IOCC competencies are not as comprehensive as the GloW competencies proposed by the GCSC global work competency model. Sustainability thinking, and the development of sustainability competency is left completely out of the IOCC mix. The authors of this paper argue that to develop holistic, future and career-oriented global work competencies, sustainability competency must be a key part of the mix. It should be considered a crucial part of a mindset and skillset for global citizenship as well as for innovative and anti-fragile New Work environments. Sustainability competency, for example, can help foster global fairness in the digital space, recognizing and honouring diversity in an equitable manner, fostering international inclusion. While online communication environments are not inherently inclusive spaces because of varied digital literacies, different communicative abilities, etc., conscious effort is made in the GCSC to mitigate these digital inequalities by engaging participants in discussion about these differences and at the same time helping students develop competencies to avoid digital marginalization, becoming more inclusive and intentional in their digital communication; and shift thinking away from the notion of being passive consumers to becoming more active members of online (learning) communities.

2.4 GloW competency model

The GCSC GloW model is based on three central competency areas: intercultural communication (and collaboration), digital communication, and sustainability (corporate and personal) competency. In enhancing the competencies of global educators and students in these three areas the GCSC is creating a movement of Global,

Conscious and Sustainable Communities (also abbreviates as GCSC). Global virtual communication is partly taken for granted in today's international business world, and it is rarely integrated into educational programs. In developing intercultural competency, students ideally enhance their self-awareness; perspective-taking; intercultural awareness and knowledge; self-directed learning in groups; self- and team organization; conflict management, communication and cooperation skills. In keeping with the principles of Education for Sustainable Development (ESD), the GCSC aims to help students acquire key competencies necessary for transformative sustainable learning. These competencies serve to strengthen sustainable personal and corporate responsibility and include complex problem-solving skills; critical/networked thinking and communication; systems thinking; and diversity, equity and inclusion in digital contexts. Digitalization of the working world is no longer just an abstract vision of the future, but a trend towards new remote 'workscapes' and (partial or complete) distance working. The GCSC focuses on developing digital communication skills including exploration and use of file-sharing tools and/or other cloud-working communication and collaboration tools, communication and facilitation skills in a virtual context (hosting and presenting skills), leading GVTs, e-conferencing know-how, as well as digital literacy and the impact of digital technology on communication within teams.

While research into language learning in a virtual environment is relatively comprehensive, research into non language related competency development in online settings remains fragmented. Kolm et al. (2021) in their systematic review of empirical studies on International Online Collaborative Competencies concluded that "(m)ethods to teach and evaluate IOCCs acquisition are underdeveloped but urgently needed" (p.183). This paper aims to position the Global Case Study Challenge as an effective and evidence-based method of competency development for HEI students, enhancing not only IOCCs but also more future-oriented and comprehensive global work (GloW) competencies – intercultural, digital communication and sustainability competencies.

3. GCSC learning architecture

The instructional design of the Global case study Challenge relies on a data driven approach. Over four iterations, qualitative and quantitative data has been collected to test whether the GCSC learning experience contributes to the development of the three core competences promoted by the program. The program relies on both online (synchronous and asynchronous) and offline learning approaches, creating a very hands-on experiential learning environment for all involved. The heterogeneity of the student groups and faculty groups is shown to be particularly important, supporting intercultural and interdisciplinary learning and teaching. This makes the topic of intercultural and global cooperation authentic and tangible, as well as work in interdisciplinary GVTs. The GCSC didactical concept and learning architecture leans on several frameworks in addition to IaH, including Virtual Exchange (VE)/Cooperative Online International Learning (COIL) and Globally Networked Learning (GNL); Project-Based Learning (PBL) through real-life case studies; and Kolbs Learning Cycle (Kolb, D. A. (2015).

3.1 GCSC as a form of accessible internationalization

Internationalization and cross-border mobility are often considered as elitist and reserved for those individuals who can afford it, while projects such as the GCSC offer institutions and individual students, who otherwise easily disengage from internationalization activities, an opportunity to participate in an IaH initiatives. As a VE/COIL initiative, the GCSC provides invaluable opportunities for intercultural and interdisciplinary exchange, the forging of new global connections, and life-enriching authentic international experiences that enhance student engagement. VE/COIL as a methodology for internationalization of the curriculum helps to develop global mindsets and create intercultural encounters that can contribute to transformative learning. The GCSC embodies the prominent values of VE/COIL practice: critical consciousness, collaboration, equity, and inclusion, which can contribute to closing a global learning gap.

3.2 GCSC promoting project-based learning

The didactical design of the GCSC is strongly student-centred, based on the "experience-based learning" approach according to the model of Kolb (1984), which represents a cyclical experience, observation and reflection, abstract conceptualization, and active experimentation. Learning is as a holistic process of experience, thinking and behaviour, where knowledge is created through the transformation of experience in the virtual and cultural interaction situation. The Project-Based Learning (PBL) component of the GCSC, in which students learn by actively engaging in real world and personally meaningful tasks (Boss, S. and Larmer, J. 2018), revolves around a series of five business cases based on the ongoing integration and re-branding process of a

major Merger and Acquisition involving a Spanish and Japanese multinational. These real-life business cases, focus on corporate social responsibility, change management, corporate communication and merging organizational cultures, learning and development, and HRM and new work. The case studies develop problem-solving skills on the one hand, but also the ability to tackle complex new work and business-related challenges on the other. Working together with a corporate partner has proven a means of forging valuable global connections and has contributed to students' global learning and digital global readiness. Students analyse the cases, develop solutions and recommendations, and then present these for the corporate partner at a global virtual conference. In applying this virtual approach to project-based learning, the GCSC helps cultivate the right mindsets to foster key future employment competencies. Reflection and learning transfer are enhanced by a post-conference live de-briefing session with international managers of GVTs. Here students can reflect on their own personal experiences and learnings, re-think these in the context of real virtual work environments and consider how to transfer their learning to the professional context.

4. Competency development: Evaluation methodology

To measure the development of the global work competencies presented here, a longitudinal study (analysing change over the 8-week period) was conducted with three quantitative instruments, measuring competencies before and after virtual exchange with all participants.

The research instruments used for the quantitative longitudinal study included an intercultural questionnaire, a digital communication questionnaire and a sustainability questionnaire. The surveying of students was conducted via the Moodle learning management system pre and post Global Case Study Challenge. Students were asked to complete the survey upon entering Moodle for the first time and were then asked to complete the same survey again at the end of the 8-week program. 263 students completed the pre-exchange survey and 274 completed it post-exchange. All three scales use a six-point Likert scale. The Intercultural Survey used was the A.S.K.S. Intercultural Knowledge and Competence survey (developed by Holgate et. al, Purdue University[1]). This is a self-assessment survey based on students' attitudes, skills, and knowledge in relation to appropriate and effective intercultural communication. The scale includes 14 items (4 relating to attitude – openness and curiosity; 4 relating to skills – communication and empathy; 6 relating to knowledge – world view and self-awareness). The digital communication competencies scale was self-developed, as no appropriate instrument was found, included 14 items (5 relating to attitude – curiosity and openness; 6 relating to skill – design and creation, use of digital formats, digital literacy and digital communication; and 3 relating to knowledge – design and creation, digital literacy and digital communication). The sustainability competencies scale was also self-developed and included a total of 14 items (6 relating to knowledge – SDGs, SDGs and environment, SDGs and education, SDGs and lifestyle and SDGs and business; 4 relating to attitude – sustainability and education, SDG and business, SDG and environment, SDG and education; and 4 relating to skill (sustainable lifestyle, SDG and environment. Researchers applied Cronbach's alpha to assess the reliability of the three selected instruments. Cronbach' α was applied for each instrument individually for pre and post data.

5. Findings

In 2021, a longitudinal study of international student participants with pre-exchange (N263) and post-exchange (N274) was conducted using three surveys with 14 questions in each survey and using 6-point Likert scale. Quantitative data for the longitudinal study was collected with the help of intercultural survey (VALUE rubric: Attitudes, Skills, and Knowledge), digital communication competency survey (self-developed), sustainability competency survey (self-developed). In the digital competencies scale and sustainability scale the results indicate a steady and consistent shift over the 2-month period in every category (Knowledge, Skills, Attitudes) from the pre-training ratings in low (1-2)-medium (3-4) range to the post-training in the medium (3-4)-high range (5-6). A slight increase in the knowledge category of Intercultural Competence development was observed, with no significant change in the category of attitudes and skills. This research demonstrates a consistent increase of competencies over time among all the program participants, providing clear evidence of the overall positive impact of the GCSC on participants' intercultural, digital, and sustainability competency development over the two-month program.

[1] adapted from the AAC&U Value Rubric: https://www.aacu.org/value/rubrics/intercultural-knowledge Developers: Holgate, H. A., Calahan, C. A., and Parker, H.E.

Table 1: Intercultural competencies

Intercultural: Attitudes Pre and Post									
	Frequency	Percent	Valid %	Accumulated Percentage		Frequency	Percent	Valid %	Accumulated Percentage
LOW	1	.4	.4	.4	LOW	2	.7	.7	.7
MEDIUM	82	31.2	31.2	31.6	MEDIUM	56	20.4	20.4	21.2
HIGH	180	68.4	68.4	100.0	HIGH	216	78.8	78.8	100.0
Total	263	100.0	100.0		Total	274	100.0	100.0	
Intercultural: Knowledge Pre and Post									
	Frequency	Percent	Valid %	Accumulated Percentage		Frequency	Percentage	Valid %	Accumulated Percentage
LOW	0	0	0	0	LOW	2	.7	.7	.7
MEDIUM	60	22.8	22.8	22.8	MEDIUM	48	17.5	17.5	18.2
HIGH	203	77.2	77.2	100.0	HIGH	224	81.8	81.8	100.0
Total	263	100.0	100.0		Total	274	100.0	100.0	
Intercultural: Skills Pre and Post									
	Frequency	Percent	Valid %	Accumulated Percent		Frequency	Percent	Valid %	Accumulated Percentage
LOW	0	0	0	0	LOW	2	.7	.7	.7
MEDIUM	42	16.0	16.0	16.0	MEDIUM	34	12.4	12.4	13.1
HIGH	221	84.0	84.0	100.0	HIGH	238	86.9	86.9	100.0
Total	263	100.0	100.0		Total	274	100.0	100.0	

Table 2: Digital competencies

Digital: Skills Pre and Post									
	Frequency	Percent	Percentage Valid	Accumulated		Frequency	Percent	Percentage Valid	Accumulated
LOW	5	1.9	1.9	1.9	LOW	1	.4	.4	.4
MEDIUM	97	36.9	36.9	38.8	MEDIUM	63	23.0	23.0	23.4
HIGH	161	61.2	61.2	100.0	HIGH	210	76.6	76.6	100.0
Total	263	100.0	100.0		Total	274	100.0	100.0	
Digital: Knowledge Pre and Post									
	Frequency	Percentage	Percentage Valid	Accumulated		Frequency	Percentage	Percentage Valid	Accumulated
LOW	3	1.1	1.1	1.1	LOW	1	.4	.4	.4
MEDIUM	83	31.6	31.6	32.7	MEDIUM	51	18.6	18.6	19.0
HIGH	177	67.3	67.3	100.0	HIGH	222	81.0	81.0	100.0
Total	263	100.0	100.0		Total	274	100.0	100.0	

Digital: Attitudes Pre and Post									
	Frequency	Percentage	Percentage Valid	Accumulated		Frequency	Percentage	Percentage Valid	Accumulated
LOW	1	.4	.4	.4	LOW	1	.4	.4	.4
MEDIUM	56	21.3	21.3	21.7	MEDIUM	46	16.8	16.8	17.2
HIGH	206	78.3	78.3	100.0	HIGH	227	82.8	82.8	100.0
Total	263	100.0	100.0		Total	274	100.0	100.0	

Table 3: Sustainability competencies

Sustainability: Skills Pre and Post									
	Frequency	Percent	Valid Percentage	Accumulated		Frequency	Percent	Valid Percentage	Accumulated
LOW	2	.8	.8	.8	LOW	2	.7	.7	.7
MEDIUM	75	28.5	28.5	29.3	MEDIUM	43	15.7	15.7	16.4
HIGH	186	70.7	70.7	100.0	HIGH	229	83.6	83.6	100.0
Total	263	100.0	100.0		Total	274	100.0	100.0	
Sustainability: Attitudes Pre and Post									
	Frequency	Percentage	Valid Percentage	Accumulated		Frequency	Percentage	Valid Percentage	Accumulated
MEDIUM	16	6.1	6.1	6.1	LOW	4	1.5	1.5	1.5
HIGH	247	93.9	93.9	100.0	MEDIUM	17	6.2	6.2	7.7
Total	263	100.0	100.0		HIGH	253	92.3	92.3	100.0
					Total	274	100.0	100.0	
Sustainability Knowledge Pre and post									
	Frequency	Percentage	Valid Percentage	Accumulated		Frequency	Percentage	Valid Percentage	Accumulated
LOW	1	.4	.4	.4	LOW	1	.4	.4	.4
MEDIUM	72	27.4	27.4	27.8	MEDIUM	9	3.3	3.3	3.6
HIGH	190	72.2	72.2	100.0	HIGH	264	96.4	96.4	100.0
Total	263	100.0	100.0		Total	274	100.0	100.0	

All three scales were analysed for reliability using Cronbach' α. Overall Cronbach alpha values of **0.7** indicate acceptable internal consistency of all three tests. In general post GCSC data has higher scores.

- 1. Sustainability Scale reliability using Cronbach' α (Knowledge, Attitudes, Skills) pre and post VE

	α Pre	α Post	
KN	.788	.827	6
ATT	.808	.885	4
SKL	.809	.854	4

- 2. Digital collaboration Scale using Cronbach' α:

	α Pre	α Post	#Items
KN	.671	.704	3

	α Pre	α Post	#Items
ATT	.841	.878	6
SKL	.841	.878	6

- 3. Intercultural Scale using Cronbach' α:

	α Pre	α Post	#Items
KN	.780	.859	6
ATT	.497	.699	4
SKL	.741	.816	4

6. Discussion and future outlook

The global Covid crisis has had a lasting impact on many aspects of academic life and has created a sort of pressure-cooker for reform of the teaching-learning environment at HEIs. Many path-breaking developments have emerged both in relation to online teaching and international collaboration across the globe. These developments are contributing to more sustainable teaching and learning practices. The importance and frequency virtual work in global virtual teams has also gained traction recently and virtual work structures have been recognized as a "lifebuoy for many struggling businesses" (Bekirogullari and Thambusamy, 2020, p.3217).

While HEIs are attaching increasing importance to the idea of building students' global competency (Deardorff and Arasaratnam-Smith, 2017), they have not yet effectively integrated the concept of sustainability thinking and sustainability competence. This is one of the factors contributing to the uniqueness of the Global Case Study Challenge, as a forward-thinking program for the development of global work competencies. Results show a consistent increase of competencies over time among all the program participants. As regards future outlook, the GCSC is currently being intentionally re-visioned as an experiential professional development (EPD) opportunity for educators, including peer-learning and networking opportunities, global educator laboratories, co-grading conferences and digital facilitation as part of the global virtual conference, this provides a host of opportunities for future research on educator learning development within the GCSC. Of particular interest, is undoubtedly the aspect of collaborative grading across different educational and country contexts, as well as the development of learning design and facilitation in the virtual space and as part of internationalization processes.

It became evident after the first two iterations that the GVTs needed more time and structure in creating a trust-building environment to generate a sense of team spirit and enhance teamwork. Hence, targeted virtual team-building activities were built into the GCSC design and included also as part of the assessment criteria. This aspect of team and leadership dynamics in virtual teams provides an interesting opportunity for future research. Teaching methods, educator professional development, and learning analytics and evaluation in online learning environments all remain under researched. These represent key aspects of virtual learning and teaching that are urgently needed to help equip students with essential global work competencies and leverage their potential to become effective professionals in high-performing Global Virtual Teams.

There is a clear need to further evaluate the GCSC proposed GloW competencies to develop a more detailed competence framework for effective work in conscious and sustainable Global Virtual Teams. The current results point towards the GCSC as an effective lab for developing these intercultural, digital communication and sustainability competencies, all of which are increasingly important in the move towards more virtual, flexible and responsible (in the context of conscious sustainability) working and living environments.

7. Conclusion

In the first two iterations of the Global Case Study Challenge, the success of the program was measured using qualitative structured reflections. In the third and fourth additions, a mixed research approach was taken, measuring competency development via qualitative reflections and longitudinal surveying of intercultural, digital communication and (in 2021) sustainability competencies. This paper presents the longitudinal data gathered from the 2021 Global Case Study Challenge and clearly demonstrates that the GCSC as a virtual exchange developing global work competencies is working. The results present clear evidence of a teaching and learning methodology that contributes to the development of global work competencies over a two-month period. In this field of research, a gap remains as to the measurement and structured reflection of competency

development for effective work and collaboration in GVTs. No comprehensive holistic model exists to meet these ends, but the GCSC's GloW model discussed here goes some way towards closing this gap.

The research presented here on global work competency development has several limitations. A clear limitation is evident in the fact that self-assessed questionnaires were used, here there is some risk that respondents either overestimate or underestimate their own competencies. The authors are conscious of this limitation. Future work in this field should include additional instruments to go beyond self-assessment. A further limitation of this research could be seen in the use of the A.S.K.S. Intercultural Knowledge and Competence Survey, which has not been developed specifically for use in virtual intercultural communication and collaboration. An alternative scale could be used here to specifically factor in the virtual dimension and its impact on intercultural attitudes, knowledge, and skills. Despite these limitation, researchers, instructional designers and educators should find the method and learning design presented here valuable and transferable.

To conclude, the GloW model can be considered as a ground-breaking new competency model for global work and work in virtual teams, combining not only key intercultural and digital communication competencies but also embedding future-oriented sustainability competencies in its design. The Global Case Study Challenge as a VE program clearly proves that it contributes to HEI students' development of these key competencies. The GloW model, the GCSC learning architecture, and the quantitative research findings presented here provide a solid foundation for future research. The increasing digitalization of both 'workscapes' and 'eduscapes' (the world of work and Higher Education), support the urgency and necessity for continued research, dialogue, and debate in validating the set of Global Work competencies proposed here. This goes hand in hand with a need for further research to identify effective strategies for teaching these competencies effectively in collaborative, international and digital educational environments.

References

Batardière, M.-T., Giralt, M., Jeanneau, C., Le-Baron-Earle, F., and O'Regan, V. (2019) "Promoting intercultural awareness among European university students via pre-mobility virtual exchanges", Journal of Virtual Exchange, 2, pp. 1-6. https://doi.org/10.14705/rpnet.2019.jve.4

Bekirogullari, Z., and Thanbusamy, R. X. (2020) "Virtual Leadership in Small Businesses during the COVID-19 Pandemic: Challenges and Possibilities", The European journal of Social and Behavioural Sciences 29 (3), pp. 3212-3224. DOI: 10.15405/ejsbs.281

Boss, S., and Larmer, J. (2018) Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences, ASCD, Alexandria, VA.

Buko, S., Knappitsch E., Covarrubias-Venegas B., Zinenko A., (October, 2021) "Developing intercultural and Digital competencies through Global Virtual teamwork: longitudinal quantitative study", Presented at the third annual International Virtual Exchange Conference (IVEC), 20 October, 2021, Chicago, USA.

Covarrubias-Venegas B., Zinenko A., Knappitsch E., Buko, S. (June, 2021) "Global Case Study Challenge: Developing Digital Leadership and Intercultural Competencies", Presented at the International COIL Latin American Conference COIL – collaborative online learning - in and with Latin America at a time of change, 14 June, 2021 (Online).

Cleary, Y., Slattery, D. M., Flammia, M., and Minacori, P. (2019) "Developing strategies for success in a cross-disciplinary global virtual team project: Collaboration among student writers and translators", Journal of Technical Writing and Communication, 49(3), pp. 309–337. https:// doi.org/10.1177/0047281618775908

Deardorff, D. K., and Arasaratnam-Smith, L. A. (2017) "Introduction", in D. K. Deardorff and L. A. Arasaratnam-Smith (Eds.), Intercultural competence in higher education: International approaches, assessment and application 1st ed., pp. 27–29, Routledge.

Gibson, C. B., and Grushina, S. (2021) "A tale of two teams: Next generation strategies for increasing the effectiveness of global virtual teams", Organizational Dynamics (2021) 50, pp.1-12.

Hauck, M. (2019) "Virtual exchange for (critical) digital literacy skills development", European Journal of Language Policy, 11, pp. 187 - 210.

Haug, E. (2017) "Examples and Outcomes of Embedding Collaborative Online International Learning (COIL) in the Curriculum", pp. 253-256, in Pixed Ed. Conference Proceedings: The Future of Education 7ed, Florence Italy, 8-9 June 2017, LibreriaUniversitaria, Padova.

Hodgson, V., and McConnell, D. (2019) "Networked Learning and Postdigital Education", Postdigit Sci Educ 1, 43–64 (2019), doi.org/10.1007/s42438-018-0029-0

Kolb, D. A. (2015), "Experiential Learning – Experience as the Source of Learning and Development 2ed", Pearson Education, New Jersey.

Kolm A., de Nooijer J., Vanherle K. et al. (2022), "International Online Collaboration Competencies in Higher Education Students: A Systematic Review", Journal of Studies in International Education, 26(2), pp. 183-201. doi:1.1177/10283153211016272

Lawrence, J., Brown, A., Redmond, P., and Basson, M. (2019) "Engaging the disengaged: Exploring the use of course-specific learning analytics and nudging to enhance online student engagement", Student Success, (2) 47.

Nandigama, S. (2021) "Global virtual exchange as a sustainable Higher Education practice: Developing innovative teaching and learning strategies using online collaboration among four international universities", in International Conference on Best Innovative Teaching Strategies (ICON_BITS), 29-31 July 2021, Pilani, Rajasthan, India.

Muszyńska, K. (2021) "A bibliometric review of research on communication in virtual project teams" Procedia Computer Science 1992 (2021), 4770-4770.

O'Dowd, R. (2017) "Virtual Exchange and internationalising the classroom", Training Language and Culture, 1(4), pp. 8-24, doi: 10.29366/2017tlc.1.4.1

O'Dowd, R. (2018) "From telecollaboration to virtual exchange: state-of-the-art and the role of UNICollaboration in moving forward", Journal of Virtual Exchange, 1, pp.1-23, doi.org/10.14705/rpnet.2018.jve.1

Olaisen, J., and Revang, O. (2017) "Working smarter and greener: Collaborative knowledge sharing in virtual global project teams", International Journal of Information Management, *37*(1), pp. 1441–1448. doi.org/10.1016/j.ijinfomgt.2016.10.002

Rubin, J. (2017) "Embedding Collaborative Online International Learning (COIL) at Higher Education Institutions", in Internationalisation of Higher Education, 2(2017), www.handbook-internatinalisation.com

Štefl, M. (2019) "Virtual exchange across disciplines: telecollaboration and the questions of asymmetrical task design", in Turula, A., Kurek, M., and Lewis, T. (Eds.) (2019), Telecollaboration and virtual exchange across disciplines: in service of social inclusion and global citizenship, Voillans, France.

Shen, Z., Lyytinen, K., and Yoo, Y. (2015) "Time and information technology in teams: A review of empirical research and future research directions. European Journal of Information Systems", 24, pp. 492–518.

Tenzer, H., Pudelko, M., and Harzing, A. W. (2014) "The impact of language barriers on trust formation in multinational teams", Journal of International Business Studies, 45, pp. 508–535.

Thomas, A. (2011) "Interkulturelle Handlungskompetenz – versiert, angemessen und erfolgreich im internationalem Geschäft", Gabler, Wiesenbaden.

Verzella, M. (2018) "Virtual exchange between cross-cultural teams: A sustainable path to the internationalization of college courses", Transforming Global Partnerships 11(3), https://td.journals.psu.edu/td/article/view/137

Zwerg-Villegas, A. M. und Martínez-Diaz j. H. (2016) "Experiential Learning with Global Virtual Teams: Developing Intercultural and Virtual Competencies", in Magis. Revista Internacional de Investigación en Educación, pp.130-146. doi: 10.11144/Javeriana.m9-18.elgv

Zilka, G. C., Cohen, R. R., and Rahimi, I. D. (2018) "Teacher presence and social presence in virtual and blended courses", Journal of Information Technology Education, 17, pp. 103–126.

Improving e-Learning Videos by Adding Sign Language Interpretation and Subtitles

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Abstract: As a professional academic supporting unit of the University, The Independent Learning Centre (ILC) at The Chinese University of Hong Kong (CUHK) has decided to provide additional support by adding sign language interpretation versions and subtitles to the existing self-learning videos. Such a project is pioneering in Hong Kong in addressing the needs of Special Education Needs (SEN) students. The project aims to benefit students with different levels of hearing impairment or other SEN as well as general students. While the revised videos will allow and encourage a wide range of students with different levels of learning difficulties to foster their independent learning skills, the added subtitles (Cantonese, Mandarin or English) can aid learning in terms of retention, comprehension, accuracy and engagement. Such benefit means general students are also expected to have their learning effectiveness increased by viewing these inclusive design videos. The whole project selected 98 videos from different self-designed online platforms, which would be over 10 hours in total. Once ready, the videos will be incorporated into the redesigned online platform and revised micro-modules accordingly. This paper aims to offer a first-handed and thorough perspective on the whole project in order to share the experience of supporting SEN and general students by making eLearning more accessible. When we are carrying out the project, we hope we can further benefit academia by sharing our successful experience. We believe the aims of the project can be further extended by sharing our experience with our academic peers, that is, our partners.

Keywords: sign language, subtitles, special education needs (SEN), videos, e-learning, independent learning

1. Background

Traditional education methods which spotlights teacher and textbook as the centre of classroom makes students passive in engaging in class. In the recent decades, new learning methods like flipped classroom, gamification, case study, social media, and self-learning are trying to tackle the problem and encourage the curiosity, creativity, and engagement of the students (Safapour, Kermanshachi and Piyush Taneja, 2019, pp. 1-5). Thanks to the fast development of technological invention and infrastructure, self-learning and distance learning through videos have been picking up popularity. Online learning has been blossoming especially from the outbreak of COVID-19. Using video to aid teaching and learning is not new to us. Whether it is for teachers to supplement teaching, to flip the classroom, to substitute face-to-face teaching, or for learners to do self-learning, these have already long existed and circulated. Research focusing on video teaching continuously improves the teaching effectiveness of using videos and provides concrete and effective reference criterion.

The research on how the design of teaching-related videos affects the viewers (students) learning effectiveness is beneficial to verifying or building various pedagogy theories. It also constructs the foundation of the practice of teaching. This explains why adding subtitles (captions) in videos which altered the amount of information and how the students receive them is attracting the attentions of researchers. Some researchers pointed out that in order to analyse the whether or not it provides positive effects by adding subtitles, one should pay attention to the video type. Although both language learning videos and content learning videos use subtitles, the learning goals of them are different. The former learning language and the latter non-linguistic contents. 'Studies have shown positive effects for subtitles for content learning in a second language.' (van der Zee, Admiraal, Paas, Saab and Giesbers, 2017, p. 19). Analysing this type of videos should focus on the learner. As an independent written content provider, subtitles extend the amount of information provided by the video. The change of information amount requires a higher cognitive ability from the viewers. Some researchers stated in order to build an effective criterion for the design of videos, the allocation of cognitive ability and attention are essential elements. (Zheng, Ye and Hsiao, 2021, p. 12). Thus, working memory limitation that corresponded to viewers should be paid attention to when designing subtitled videos. One should keep the visual-textual information complexity (VTIC) to a low level on subtitled videos. Adding extra subtitles on videos that already contain a high amount of visual–textual information brings cognitive overload. It is detrimental to learning effectiveness. (van der Zee, Admiraal, Paas, Saab and Giesbers, 2017, pp. 19-20). Cao Jian-xia, Yang Rong-hua, and He Li-ming's research supports this point. Their research set up three groups of students to compare with each other. These groups of students watched videos of Russian history with no-subtitle, brief-subtitle, or full-subtitle respectively. Given the

high amount of text information presented to the students by providing PowerPoint slides, 'subtitle presentation led to visual channel overload, which affected effective information processing'. the result is that the learning outcome of the brief-subtitle group and full-subtitle group were similar and both significantly lower than that of the no-subtitle group (Cao, Yang and He, 2019, pp. 144-147).

2. Aims of the project

The Independent Learning Centre (ILC) at The Chinese University of Hong Kong (CUHK) is eager to improve all existing eLearning resources, especially those videos on various self-developed Subject-Specific Online Platform. CUHK has always been trying to provide the best support for Special Education Needs (SEN) students. As stated in the University's 'Strategic Plan 2021-2025':

> *to ensure that no students will be left behind in the rapid advancement of eLearning, attention must be given to providing additional support to students with special education needs (SEN). (The Chinese University of Hong Kong, 2021, p. 25)*

As a professional academic supporting unit of the University, ILC has decided to provide additional support by adding sign language interpretation versions and subtitles to the existing self-learning videos. While adding sign language interpretation videos can directly benefit students with different levels of hearing impairment, Joong-O Yoon and Minjeong Kim have also found out that:

> *providing captions in online content for deaf individuals along with sign language video clips had a positive effect on learning that exceeded that of sign language video clips alone. (Yoon and Kim, 2011, p. 287)*

Moreover, the subtitles would benefit students with attention deficit hyperactivity disorder (ADHD), autism and dyslexia (Rev, 2017). Existing and future SEN students could all be benefited by this design. From 2017-2021, CUHK has admitted 424 students (University Grants Committee, 2022) that belong to 11 types of SEN:

- 1. Attention Deficit/Hyperactivity Deficit (ADHD)
- 2. Autism
- 3. Hearing Impairment
- 4. Mental Illness
- 5. Multiple types of Disabilities (for example Autism with ADHD, Autism with Hearing impairment etc.)
- 6. Physical Disability
- 7. Specific Learning Difficulties (for example Dyslexia, Non-verbal Learning Disabilities etc.)
- 8. Speech Impairment
- 9. Visual Impairment
- 10. Visceral Disability
- 11. Others

Based on the above arguments, 290 in total out of the 424 students could be benefited by the subtitles added (40 have Hearing Impairment; 57 have ADHD; 41 have Autism: 40 have Specific Learning Disability and 112 have Multiple types of Disabilities (University Grants Committee, 2022).) and the actual number would probably bigger as this data only shown the number of full-time students who report voluntarily to the University about their disabilities.

The subtitles added to self-learning videos would also benefit the general students. A research conducted in the fall of 2015 by the Oregon State University Ecampus Research Unit with 3Play Media that collected responses from 2000 university students across United States has found out that not only students reporting disabilities use subtitles at least sometimes (over 61.1%), over 50% of student not reporting disabilities also at least use subtitles occasionally. (Stritto and Linder, 2017). Most of the respondents would use the closed subtitles to help them focus, retain poor information, and overcome poor quality of videos. Small amount of the respondents would use the subtitles to learn a second language. (Linder, 2016, p.12) Hence, we can expect making existing self-learning videos more inclusive by adding Chinese (Cantonese/Mandarin) or English subtitles corresponding to the dialogues, can benefit all student of the University as learning aids that could help the user on retention, on comprehension, on accuracy and on engagement.

Currently, supports for the SEN students in CUHK is provided by the Wellness and Counselling Centre of Office of Student Affairs (OSA). However, the center's support focuses on 'enable disabled students to actively participate in campus life and to facilitate their learning' (Office of Student Affairs, 2022), which means providing services such as campus transportation, accommodation, learning equipment, special lecture and examination arrangements and not focus on supporting SEN student to foster their independent learning skills through eLearning.

Hence, this initiative by ILC, adding sign language interpretation versions and subtitles to the existing self-learning videos, would be one of the first university-level projects in CUHK that aims at providing supports to the eLearning needs of the students with multiple type of disabilities and hearing impairment in CUHK. Not only at CUHK, such project is pioneering in Hong Kong on addressing the needs of SEN students. The self-learning videos created for the SEN students will encourage them to practice eLearning by using the resources and service of ILC, and also acquiring essential skill, such as academic writing skills and interview skills through online learning platform. Inclusiveness and learning effectiveness are expected to increase through making the new version. More students can be encouraged to do electronic- and self-learning.

The project would be suiting one of the main goals of the 'Strategic Plan 2021-2025' not by just providing direct learning support to the SEN student, but also by sharing the experience and setting up an example for other teaching units in CUHK. The experience sharing sessions and research findings presentations of this project can raise awareness and encourage more teaching units to offer supports in SEN student's eLearning needs. Furthermore, the products and arrangements of the project can be a reference for the interested parties to develop their own 'additional supports' to the SEN students.

3. Methods for achieving the aims

The project aims at carrying system-level improvement in teaching and learning activities in the following ways:

- 1. Provide direct support to the eLearning needs of the current and future SEN students.
- 2. Encourage the SEN students to take control of their own learning by practicing self-learning on academic writing and job search related skills anywhere and at their own pace.
- 3.Encourage the general students to use the subtitles added as learning aids on retention, comprehension, accuracy and engagement to increase their learning effectiveness.
- 4. Assist both SEN and general students to develop their independent learning skills by introduce resources and services with inclusive design videos.
- 5.Enable and encourage a more direct interaction between SEN and general students by viewing the same inclusive design videos.
- 6. Promote awareness of the learning needs of the SEN students among staffs and general students.

To achieve the aims, the project plans to produce a considerable number of videos. 98 videos that over 10 hours in total will be produced. All videos can be divided into 3 types:

- (A) Sign language video with English, Mandarin or Cantonese subtitles added.
- (B) Videos with English, Mandarin or Cantonese subtitles added.
- (C) Sign language video without subtitles.

All selected videos are from 4 different online learning platform that developed by ILC. The distribution and the length of time of all the video are as follows:

Table 1: The distribution and the length of time of all the video

Platform	Type of videos						Total length of time
	A	Length of time	B	Length of time	C	Length of time	
Orientation of ILC	1	4 mins and 30 seconds	1	4 mins			8 mins and 30 seconds
GE Reflective Journal Micro-Modules (TDLEG)	5	13 mins and 53 seconds					13 mins and 53 seconds

Platform	Type of videos						Total length of time
	A	Length of time	B	Length of time	C	Length of time	
中文思辨寫作（與人文對話及與自然對話）(TDLEG)	10	26 mins and 36 seconds	10	3 mins and 46 seconds			30 mins and 22 seconds
The Interview Skills Development System Extended (TDG)	12	7 hours, 46 mins and 43 seconds	49	1 hour, 24 mins and 23 seconds	10	32 mins and 9 seconds	9 hours, 43 mins and 15 seconds
Grand total	28	8 hours, 31 mins and 42 seconds	60	1 hours, 32 mins and 9 seconds	10	32 mins and 9 seconds	98 videos; 10 hours and 36 mins

We will setup peer sharing sessions ourselves or in collaborate with other units, such as Centre for Learning Enhancement And Research (CLEAR) or Office of Student Affairs (OSA), for interested university staff members and students on sharing their experience on making use of the videos.

Among the various types of videos produced by ILC, academic writing and career-related videos are the most welcomed. Thus, we selected the types of videos above to add subtitles or create a sign language interpretation version.

Figure 1: All the subtitles and sign language interpretations can be enabled or disabled by the viewers

To facilitate the self-learning practice, all the subtitles and sign language interpretations can be enabled or disabled by the viewers. (see Figure 1)

Figure 2: The video introducing the mission of ILC has two versions (Cantonese)

Figure 3: The video introducing the mission of ILC has two versions (English)

The video introducing the mission of ILC has two versions, an English one and a Cantonese one. Both videos can be found in the 'About ILC' at the ILC website. (see Figure 2 and Figure 3) They have been being played on the new student orientation events for every new intake of under- and post-graduates. The two videos have been reaching to the widest variety and the largest number of students. Another type of videos got high hit rates among first and second year undergraduates is about writing reflective journals for the university general education courses. CUHK requires all undergraduate to take three credits of 'In Dialogue with Humanity' and another three of 'In Dialogue with Nature' as their graduation requirement. Both courses set a homework of reflective journals in English or Chinese.

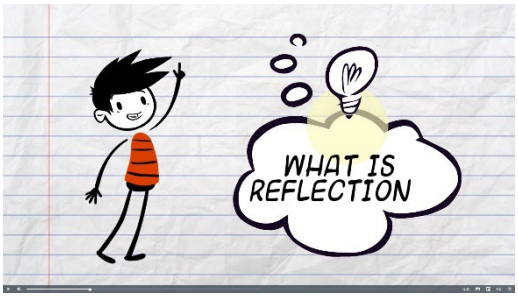

Figure 4: The English platform

ILC cooperated with the University General Education Foundation Programmes to launch a Micro-modules of Reflective Journal Writing for University General Foundation Programme. Micro-modules consist of online platform and workshops. The Chinese online platform explains essential knowledge and marking rubrics of writing papers through different kinds of instruction tools. Tools include self-learning videos, hints, exercises, references, and supplementary explanations (Chao, 2018, p. 142). Students can use the tools at their own pace. The English platform (see Figure 4) added a learning route in order to aid the students at different chapters can find a suggested route to make the best use of the whole platform. For the videos that have the sign language added, the interpretation is embedded with a 3:7 ratio to the original video (see Figure 5). Subtitles can also be selected to show simultaneously. Students can choose whatever they see fit.

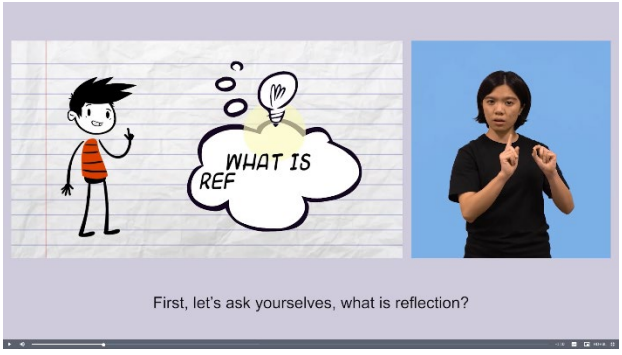

Figure 5: The interpretation is embedded with a 3:7 ratio to the original video

Career-related videos are also highly welcomed by the students. It helps participants with interview stills, scholarship applications, internship seeking, academic exchange applications, and graduate degree applications. These videos are placed or co-related to the online platform called 'Interview Skills Development System Extended Version' (see Figure 6). In total there are 51 videos with the length of 58 mins to 1 hour and 24 mins. Editing and uploading is still undergoing.

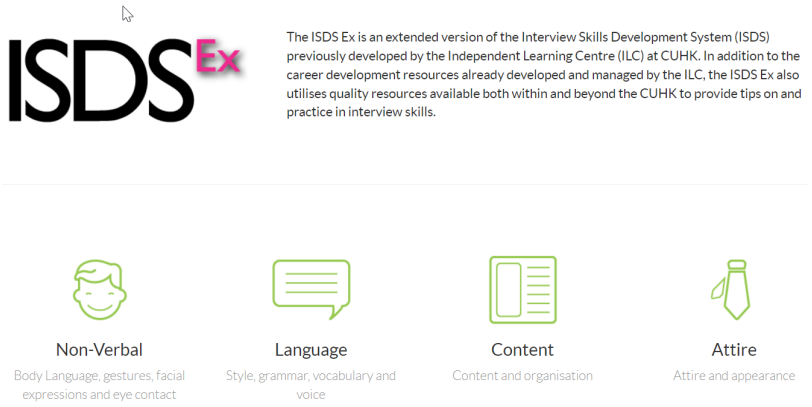

Figure 6: interview skills development system extended version

4. Evaluation

Most of the videos (96 out of 98) are part of the online learning platforms. Number of accesses to the videos (viewing) can be recorded and students can provide written comments in the feedback section of the online platforms.

ILC designed questionnaire and asked the teaching staff members taking care of the university general education to forward it to all the students (see Figure 7).

Figure 7: Questionnaire

Among the information collected during 7 February to 9 March 2022, students are being very positive to the subtitles (there are no student who knows sign language replied in the period). 14 students replied 'Clearly understandable' for the question 'Do you think the subtitles added is clear and understandable?' 4 of them stated 'Subtitles are very clear and understandable and fits well with the video. Moreover, they can be read individually so that one can read to understand the video content.'

Students take the subtitles as a positive add-on to the videos. It helps them understand the video and assists their learning process. Regarding the questionnaire question 'Do you think the video with subtitles added is helping you on understanding the content and notion taught?' all 14 students replied 'Yes' and 11 of them selected 'Able to help me on understanding the gabbled parts or the minor points that might easily be missed'. 9 of them selected 'Able to help me understand more deeply the content' and 8 'Able to make me understand thoroughly some concepts'.

In the section that allows students writing their own opinions, they highlighted some first-handed experience on using the subtitled videos: 'Subtitles help me to concentrate watching the video', 'Subtitles make self-learning more convenient', and 'As Chinese is my mono-mother tongue, I am not familiar with certain kinds of the articulation of English. Subtitles help on understanding.' The last comment quoted reflects subtitles help students overcome the difficulties on learning through a second language.

From the figures and analysis above, we can see that students regard the subtitles add-on raises their learning and self-learning effectiveness.

Furthermore, the Office of Student Affairs (OSA) that takes care of SEN students was contacted to help recruiting student helpers to give us feedbacks after they have reviewed the videos. We selected and interviewed the applications and appointed 6 student helpers, 5 of whom are with SEN. Feedback reports were received on early April 2022. Each participant is required to hand in four reports focusing on (1) Orientation of ILC; (2) GE Reflective Journal Micro-Modules (TDLEG); (3) 中文思辨寫作（與人文對話及與自然對話） (TDLEG) with Mandarin subtitles; and (4) 中文思辨寫作（與人文對話及與自然對話） (TDLEG) with Cantonese subtitles respectively. Here is a summary of the result on captions (only one of them is able to read sign language so it is excluded as the sample size is too small):

Table 2: Summary of the result on captions

Platform	**Feedback**				
	Caption accuracy and clearness	Helpful on understanding content	Helpful on understanding concepts being presented	Helpful on understanding content for SEN students	Helpful on understanding concepts being presented for SEN students
Orientation of ILC	Slightly agree: 2 Agree: 4	Agree: 5 Strongly agree: 1	Slightly agree: 1 Agree: 4	Agree: 4 Strongly agree: 2	Agree: 4 Strongly agree: 1
GE Reflective Journal Micro-Modules (TDLEG)	Slightly agree: 1 Agree: 3 Strongly agree: 2	Agree: 5 Strongly agree: 1	Agree: 4 Strongly agree: 2	Agree: 4 Strongly agree: 2	Agree: 4 Strongly agree: 2
中文思辨寫作（與人文對話及與自然對話）(TDLEG) Mandarin subtitles	Slightly disagree: 1 Agree: 4	Slightly agree: 2 Agree: 3	Slightly agree: 2 Agree: 3	Slightly agree: 1 Agree: 4	Slightly agree: 1 Agree: 4
中文思辨寫作（與人文對話及與自然對話）(TDLEG) Cantonese subtitles	Slightly agree: 1 Agree: 3 Strongly agree: 3	Slightly agree: 1 Agree: 5 Strongly agree: 1	Slightly agree: 2 Agree: 5	Slightly agree: 1 Agree: 5 Strongly agree: 1	Slightly agree: 2 Agree: 4 Strongly agree: 1
Percentage on the 'agree' realm	95.8% (23/24)	100% (24/24)	100% (23/23)	100% (24/24)	100% (23/23)

Besides the numeric rating, we emphasised the importance of written comments on the reports therefore we received quite some well-developed feedbacks. Overall, the comments can be categorised into three main aspects of the benefits of adding subtitles. The following quotes are all verbatim copy from the comments.

5. Understanding video contents

The reports showed that the subtitles helped the viewers to understand the content. A student said, 'I absolutely agree that adding captions enables us to more accurately get the information. I find it particularly useful when

some important information is mentioned'. In a report from a student who has special education needs, subtitles can be a big help on enabling viewers to overcome the barriers unintentionally set up by the use of PowerPoint (and other similar presentation aids). It said, 'since I am not able to read the images, PPT or effects shown on the screen for example via share-screen function, it'd be better if those information can be included in the caption bar.'

Besides understanding the content when watching the videos, students also found that subtitles helped them on note taking. 'It's easier for me to take notes and I can also refer to the subtitles for some key terms. As a visually impaired, it's not so convenient for me to take notes while listening to the speaker. When there is subtitle available, I can concentrate on the presentation while when clarification or note-taking is needed, I can refer to the subtitles.' Here comes another report, 'adding captions is effective for assisting self-learning because they help students take notes from the videos more easily. For example, when the instructor talks about different points in expressing opinions appropriately, the captions can help students absorb the methods taught more quickly, without a need to repeat the video.'

6. Keeping pace with the video

Subtitles also give the viewers a peace of mind that the message delivered in the vocal way will also be presented in a written form. 'I think that through adding captions, I have been able to follow up with the pace of the video, and the captions has allowed me to further increase my understanding in the video.'

Even though the video quality is not ideal or the presentation speed is not fitting in all students' need, subtitles play an important role on delivering key messages. 'Sometimes, the audio quality may not be very clear, so it is useful to have captions in order to clarify what the instructor says.' 'I definitely think that adding captions is good for these videos as I find it hard to follow what the speaker is teaching. It allows me to further understand better what is being addressed.' 'It allows me to be able to catchup with what the speaker is saying, it also further encourages me to conduct self-learning.'

7. Aiding second language users

In CUHK, and the whole Hong Kong as well, it is normal to use the all three dominating languages (Cantonese, English, and Mandarin) to communicate even in the same course. Subtitles can be of great help for students watching a video presenting in their second (and more) languages. 'I think that adding these captions is good. As for me, I am not great at Putonghua [note: Mandarin], after being able to read the subtitles while watching the speaker, I was able to better understand what the speaker is saying and catchup. It encourages me to conduct self-learning as I am in a better zone of proximal development as I am not the best in Putonghua. The subtitles allowed me the ability to comprehend the concepts being said more clearly in a more convenient way.'

In tertiary institutes in Hong Kong, English is an essential ability that needs to be mastered. Subtitles can help those who are lagging behind on languages not failing to grasp messages that they are capable to understand if there is no language barriers. 'Caption additions are nice for this type of video because not all students have good English listening skills. To better catch up with the speaker, captions are always helpful. It does assist me to conduct self-learning. For example, there are several sophisticated words that I seldom encounter in daily life like "intuitively". This helps me to save the time of listening over and over again to understand the word and the whole sentence.' The use of language on teaching is never merely about the listeners, the educators played an equally (if not more) important role. 'For the English version the speaker unintentionally slurred on certain words, like "curriculum", "workshops", "participation", "address" and "diverse" which I have to turn on the captions in order to understand what she is saying.'

Here comes the strongest claim on the subtitles on aiding viewers on watching second language videos: 'I cannot catch up if there was no caption.'

There are, however, some comments against using subtitles on some kinds of videos. For videos like introductory videos that 'does not involve the use of jargons', a comment stated 'I think captions here are a bonus, but not necessary'. Therefore, we tend to keep the function that enables the viewers to choose switching on or off the aids.

8. Future development

To further improve the project, it will be introduced to the partners of ILC besides the OSA, such as Office of University General Education, University library system, Colleges etc. Both online and printed promotion materials well be prepared. Department or unit who wants to encourage SEN students in CUHK to take control of their learning by providing suitable supports on eLearning can take reference. Promotion video and information of the project will be uploaded to ILC webpage and other available channels. In terms of reaching out, the design and findings of the effectiveness of this platform will be presented in conferences, workshops, and academic papers. The outcomes and effectiveness of this project will be shared.

9. Conclusion

Adding subtitles and sign language interpretation on the videos is to make the video more accessible to different types of students in university. A function that enables the viewers to choose switching on or off the aids is to raise the learning effectiveness. It can encourage the students to use eLearning in a more effective way and nurture a larger group of self-learners who can learn in their own pace. By the elementary evaluation on the videos available, we can see that students are providing positive feedbacks on subtitles aiding them to raise effectiveness on learning and self-learning.

This paper offers a first-handed and thorough perspective on the whole project of adding subtitles to self-learning videos. This is to share the experience on supporting SEN and general students by making eLearning more accessible. When we are carrying out the project, we plan to further benefit the academia by sharing our successful experience. We believe the aims of the project can be further extended by sharing our experience with our academic peers, that is, our partners.

References

Cao, J.X., Yang, R.H. and He, L.M. (2019) 'Effect of Subtitle Presentation Types on Students' Learning Outcome and Cognitive Load.' *Proceedings of the 2019 11th International Conference on Education Technology and Computers*, pp 144–147.

Chao, L.Y.F. (2018) 'Daxue tongshi juchu kecheng sibian xiezuo weixing xuexi danyuan de sheji' 大學通識基礎課程思辨寫作微型學習單元的設計. In Li, X.Q., Sun, J.R. and Xu, J. (eds.) *Shuzihua Hanyu jiaoxue* 數字化漢語教學. Beijing: Tsinghua University Press, pp 141-148.

Linder, K. (2016) *Student uses and perceptions of closed captions and transcripts: Results from a national study*. Corvallis, OR: Oregon State University Ecampus Research Unit.

Office of Student Affairs. (2022) *Wellness and Counselling Centre*. [Online] Available at: https://www.osa.cuhk.edu.hk/sections/wellness-and-counselling-centre [Accessed 3 May. 2022].

Rev. (2017) *How Captions Benefit More Than the Deaf and Hard of Hearing*. [Online] Available at: https://www.rev.com/blog/how-captions-benefit-more-than-the-deaf-and-hard-of-hearing [Accessed 3 May. 2022].

Safapour, E., Kermanshachi, S. and Taneja, P. (2019) 'A Review of Nontraditional Teaching Methods: Flipped Classroom, Gamification, Case Study, Self-Learning, and Social Media.' *Education Sciences*, 9(273), pp.1-20.

Stritto, M.E.D. and Linder, K. (2017) *A Rising Tide: How Closed Captions Can Benefit All Students*. [Online] Available at: https://er.educause.edu/articles/2017/8/a-rising-tide-how-closed-captions-can-benefit-all-students [Accessed 3 May. 2022].

The Chinese University of Hong Kong. (2021) 'CUHK Strategic Plan 2021–2025.' [Online]. Available at: https://www.cuhk.edu.hk/strategicplan/cuhk2025/assets/docs/CUHK_SP2025_full_en.pdf [Accessed 3 May. 2022].

University Grants Committee. (2022) *Customised Data Retrieval*. [Online] Available at: https://cdcf.ugc.edu.hk/cdcf/statEntry.action [Accessed 3 May. 2022].

van der Zee, T., Admiraal, W., Paas F., Saab N. and Giesbers B. (2017) 'Effects of Subtitles, Complexity, and Language Proficiency on Learning from Online Education Videos.' *Journal of Media Psychology Theories Methods and Applications*, 29(1), pp 18-30.

Yoon, J.O. and Kim, M.J. (2011) 'The Effects of Captions on Deaf Students' Content Comprehension, Cognitive Load, and Motivation in Online Learning.' American Annals of the Deaf, 156(3), pp 283-289.

Zheng, Y.Y., Ye, X.C. and Hsiao, J.H. (2021) 'Does Adding Video and Subtitles to an Audio Lesson Facilitate Its Comprehension?' *Learning and Instruction*, 77(1), pp 1-13.

The Impact on Learners' Identities of Aligning Pedagogy, Design and Technologies With Theory in Online Courses

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Abstract: In the past two decades, much of e-learning scholarship has reflected the tensions between what we as educators aspire to do, the theory we have to support what we do, and what we actually accomplish when it comes to technology supported learning. Some scholars are recognizing that inroads to resolving these tensions can be gained through a deeper understanding of the kinds of identities we promote in learners through our pedagogies, course designs and technologies. If our goals are to promote empowered, self-directed and life-long learners in our programs, then the practices, designs and technologies we employ must all be framed by theories that support such goals. Too often this is not the case. This study forms part of a larger longitudinal inquiry aimed at aligning these three components with 21st century goals and contemporary e-learning theory at a fully online higher education (HE) technical institution in Chile. An earlier pilot focussed on the reaction to this new alignment from the institution's broad student body of working adults (n=2,300), the majority from socially and academically disadvantaged backgrounds. Narrowing the lens on a small cohort of students (n=14) entering the institution into a cross section of career disciplines, we adopted a qualitative case study approach to uncover a deeper understanding of the identities of these students on first arrival. Our objective was to determine how highly interactive group work-based teaching practices, learner-centred instructionally designed programs and social media-based technologies such as forums and live videoconferencing sessions, impacted their identities over the course of the first 5-month period. Data collection involved in-depth individual and focus group bi-weekly interviews, reflective feedback from routine student questionnaires, field notes, instructor observations and digital activity online. Findings indicated the crucial nature of this initial period for influencing student's learning trajectories in terms of retention and for promoting the kinds of 21st century learner identities to which the institutional programs aspired. As a surge of institutions worldwide are more motivated than ever to finding effective e-learning solutions after experiencing challenges in their online programs during the pandemic, these results could provide empirical evidence of a viable pathway forward.

Keywords: higher education, instructional design, distance learning, contemporary learning theories and goals, learner identity

1. Introduction and background

Despite the outpouring of literature that the COVID-19 pandemic has generated (Zhang et al., 2022) and the pessimism about online learning that in many cases it reflects, calls for understanding how to resolve issues such as learner engagement and learning challenges in e-learning settings, continue to resound. Calls for solutions in online learning spaces existed even prior to the pandemic and revolved around ways to connect theory to practice (Pange and Pange, 2011). The more recent ones are all the more urgent given predictions of a surge to distance and hybrid/blended learning in the post pandemic era (Rosenberg, 2021). While promising e-learning theories have been developed over the last 2 decades (Picciano, 2017), few have been put into 'real' use (Rientes and Toetenel, 2016). More recently, scholars have argued that inroads to resolving this dilemma involves applying instructional designs that reflect 21st century pedagogical practices and are supported by social media technologies in these settings. Yet, while the process of aligning pedagogy, instructional design and technology in virtual learning spaces has received some interest (Charbonneau-Gowdy and Galdames, 2021), there is a paucity of empirical evidence that shows the impact of this action on learners and learning.

The research study we report on here is part of a larger longitudinal study that takes place in a technical institute in Santiago, Chile. The driver of the original study was upper-level administrators acknowledging inconsistencies between the policy frameworks guiding their fully online programming and the kinds of high-quality returns that both institutional leaders and students expected. Although policies claimed to focus on learners and learning and to prepare students for the futures they will face in their technical careers, the instructional design model instead reflected outdated pedagogical teaching practices and the technical resources that supported industrial era workplace processes. In the larger study, our objective was to put in place action research (AR) involving all levels of the institution to address this disconnect (Charbonneau-Gowdy and Galdames, 2021). Encouraging findings indicated salient changes in learners' behaviours and in their identities. While these preliminary results of the AR were seen as promising, given that they were based primarily on quantitative results, it was clear that

a deeper understanding of such changes could confirm the connection to the alignment of pedagogy/design/ and technology initiative and not simply to the opportunities for further education, in and of itself.

In the present study, our focus was on a small group of 14 students, all working adults, a majority with similar profiles - disadvantaged backgrounds both socio-economically and educationally. The self-selected participants were in their first months of adapting to an online distance education context and being exposed to the institutional change initiative. Our aim was to unpack at a deeper level the images these individuals had of themselves as learners, i.e. their identities, on arrival at the institution and to trace any evolvement of both their identities and learning practices in the initial months of their programs. By gathering richer information about the various identities these individuals were mediating, we felt better able to assess our institutional-wide initiative and to use this empirically grounded knowledge to make alterations to the programming, as needed. We were also aware of the importance of understanding their experiences and its impact on learners' sense of selves in the first few critical months in distance learning programs to questions related to attrition and retention (Aina et al., 2021) – of concern in all distance learning programs.

With these goals in mind, the following questions were used to frame the study:

- 1. What kinds of identities as learners does a small group of working adults in Chile arrive with when enrolling in a distance learning technical program?
- 2. How do their identities as learners evolve, if at all, over the first three months in the program?
- 3. What connection, if any, can be drawn between the program's alignment of pedagogy practices, course design and technologies used and the identity changes and learning practices of this group of individuals?

2. Theory and literature underpinnings

Underpinning our study were established contemporary learning theories, especially those reflective of sociocultural perspectives and 21st century goals that: a) place learners and their agency at the centre of learning processes; b) are predicated on the understanding that learning is a complex social interactive phenomenon; c) involve learners in community collaborating on co-constructing knowledge based on their individual social contexts and experiences; and d) have important implications for learners' competencies and identities in a dynamic, technology-driven society. The three components of the initiative we had put in place in the institution involved: i) the pedagogical practices of instructors and learners online, ii) the instructional designs at the basis of these practices (ID), and iii) the technology tools supporting the programs. Together these components were intended to reflect the theoretical principles and goals listed above and to examine their impact on learners' identities and practices.

2.1 Current online learning theories, models and designs

Scholars working to develop a model for online learning and distance education that reflect these perspectives and goals have been especially influenced by Garrison, Anderson and Archer's (2000) Online Learning Theory (CoL), Siemans' (2004) Connectivism Theory of Online Learning (CTOL) and Harasim's, (2012) Online Collaborative Learning theory (OCL). Based on these three e-learning theories, social interaction is framed through building deeper participation in a community of learning (CoL), moving internal individualistic internet activities to group, community and even crowd ones (CT), and through collaborative processes of knowledge construction (OCL). Within all three theories, learners are seen as active participants involved in a symbiotic relationship with others and with powerful technology tools that can lead to their learning.

Picciano's (2017, p.178) Multimodal Model for Online Education (Figure 1), heavily influenced by the CoL, CTOL and OCL theories was particularly relevant to our study context. The seven intersecting components of the model comprise the essential opportunities for learning available in a quality online program – through *media content*, *reflection*, *collaboration*, *assessment, dialogue, self-directed learning* and *social/emotional support*. These components are reflected in the pedagogy/design/technology aligned programs that participants and all newcomers to the institution were confronting in returning to formal learning after many years, and in an online site. These components help frame the kinds of adaptations students were expected to mediate in terms of their practices and identities and are integral to understanding their experiences.

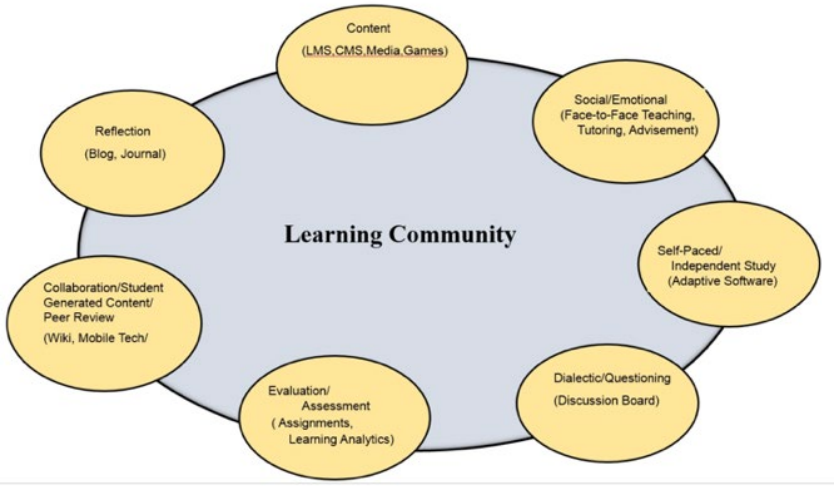

Figure 1: Multimodal model for online education (Picciano, 2017

Instructional designs (ID) are considered an effective vehicle to ensure conformity in applying theory, models and technology into effective practice. Yet, as pointed out above and given the challenges reported online during the pandemic, there has been relatively little uptake of this strategy in distance learning settings. One reason for this stalemate appears to be the lack of empirical evidence to show the viability and impact of applying contemporary learning theory-based IDs more broadly and over sustained periods. Margaryan et al (2015) used 10 guiding principles of effective online learning practice (Table 1) to compare and evaluate the IDs of 75 MOOC programs. Surprisingly, the authors found that the IDs in all of these programs rated poorly according to their scale. In the context of the present study, these ID principles are reflected in the pedagogical practices being initiated in all programs across the institution.

Table 1: Guiding principles of effective IDs (Margaryan et al., 2015)

Guiding Principle	Description
Problem-centred	Learners learn skills in the context of real-world problems
Activation	Learners activate their existing knowledge and skills for developing new skills
Demonstrated	Learners learn when exposed to 'real' examples of new skills to be learned rather than information.
Application	Learners have opportunities to apply their new skills to solve problems.
Integration	Learners have opportunities to reflect on, discuss and defend their new skills
Collective Knowledge	Learners contribute to collective knowledge
Collaboration	Learners collaborate with others to build knowledge
Differentiation	Learners have options according to their individual needs
Authentic Resources	Learners are put in real world situations
Feedback	Leaners are given regular feedback

2.2 Perspectives on identity and investment in online learning

In viewing learning from a sociocultural perspective, the multiple nested contextual influences – political, social, cultural, economic, that exist in learning spaces, are receiving increased attention. Norton (Darvin and Norton, 2015) defines identity as "the way a person understands their relationship with the world, how that relationship is built across time and space, and how the person understands the possibilities for the future" (p. 4). Viewed through this lens, identity is conceptualized as a site of struggle, structured by relations of power existing in social contexts - including within educational systems. As Bourdieu (1998, p.43) points out: "A large part of social suffering stems from the poverty of people's relationship to the educational system, which not only shapes social destinies but also the image they have of their destiny."

Historically, and evidently during the pandemic, online education has positioned learners as passive recipients of information that they are expected to manipulate, and in roles that involve acts of human/machine interactions. In this scenario, learners are forced to assume marginalized and incompetent identities, where their desires to build social, cultural, symbolic and economic capital are denied. Norton has coined the term 'investment' (Darvin and Norton, 2015) to explain an opposite scenario in which learners are provided opportunities for exerting agency in their learning through interaction and knowledge building with others. In these social interactions, increasingly occurring in digital spaces, an individual's strengths, experience and

knowledge are recognized. In reaction to such favourable conditions for exercising agency, their desire to invest in learning is ignited with a view to gaining a broader range of symbolic and material resources. In other words, in these ideal conditions, learners will choose to engage and invest in learning for the value they see in doing so for increasing their capital and social power and for the visions they have of their futures. (Darvin and Norton, 2015).

Engell and Coll's (2021) model (Figure 2) of learner identity (LI) also served to frame our inquiry. This model explains the various components in learning contexts, including multimodal-based ones, that are involved in the act of identity mediation. The elements include: i) reasons for participating in learning activities and the learning goals pursued; ii) significant others participating in the learning experiences and their acts of recognition; iii) discursive resources present in the broader sociocultural context; iv) convergence or interference of other identities of a person; v) characteristics of the learning activities; and vi) emotions associated with the learning. Importantly, the model exposes the critical nature of social context and material resources to our understanding of learner mediation of identity especially in online sites.

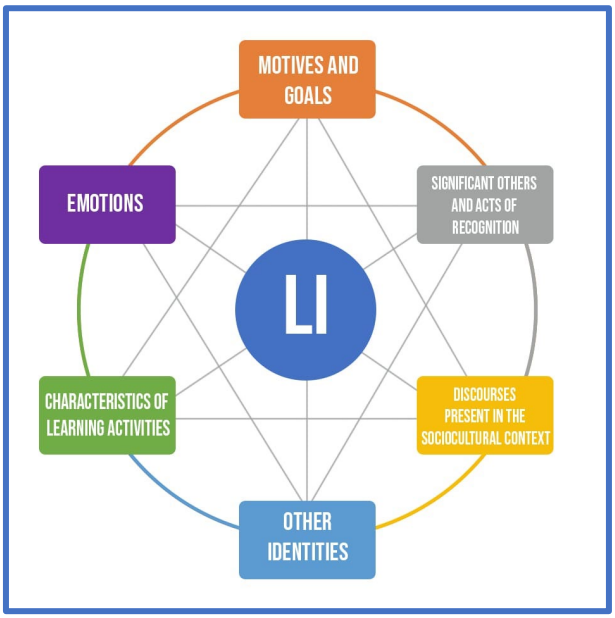

Figure 2: Elements involved in mediating learner identities (translated from, p.5)

Each of the models and theories discussed above supported our analysis and understanding of the stories from participants about their past educational experiences and those they were living in the initial stages of the distance learning program.

3. Methodology

The study took place over five months between March and July, 2022. It is positioned within the qualitative paradigm in which we adopted a case study approach due to: i) the complex understandings we were seeking through our research questions and ii) the relevancy of the contextual conditions in the study site to the phenomenon we were studying (Baxter and Jack, 2008). E-learning research is increasingly being recognized as a social-based practice (Gruba et al., 2016), especially by many who experienced online learning during the pandemic. The "growing maturity and global influence of qualitative research in the human disciplines" (Denizen & Lincoln, 2018, p. 9), its suitability for uncovering knowledge embedded in complex human experiences and for revealing participants' voices (Creswell, 2007), supported our research aims.

Data Included: 1) transcriptions of bi-weekly group and individual interviews; 2) online classroom observations; 3) participants' written reflections of the challenges and highlights; 4) field notes that included digital activity in the forums and feedback from faculty. Ethical guidelines established by our institution to protect the rights and privacy of the participants were strictly adhered to throughout the study process.

3.1 Context and participants

The study took place at a HE technical institute in Chile. Chile is considered an economically stable country, one of only two OECD members in South America. Despite its stability, for over a decade the deep socio-economic divide in the country has led to annual violent student protests seeking greater access to education. In the years between 2014-2018, HE enrolment numbers rose 140.7%. As a further indication of the demand for equity, in 2019 country-wide rotating strikes protesting inequality in education, health care and pensions as well as privatization and high living costs, rocked the country and brought it to a standstill for several months. The country has recently elected a leftist coalition government – a dramatic about-turn after years of predominantly right-leaning ruling parties whose interests have been closely aligned with upper class society, powerful religious bodies and business interests. Despite great hope in this new government and its promise of change, a recent vote on a referendum-driven initiative to rewrite the constitution that would have reversed many existing policies, has failed to pass.

The institute where the study took place is privately owned, founded in 1985. Since 2017, it has offered 100% online programs, one of few HE institutes in Chile pre-pandemic to do so. The institution provides technical courses in 15 career streams organized in 5 areas: administration, education, industrial, health and social. Its mission statement not only includes the development of the professional skills and competencies of its students, but also the promotion of their well-being, attitudes and empowerment to respond to the current dynamic demands in work lives.

The student body consists generally of fully employed individuals, the majority from socially, educationally, and economically deprived backgrounds, seeking to upgrade their skills and/or obtain certification to enable career changes in technical areas. The programs receive an influx on average of 1,600 new students bi-monthly, made up of 58% female and 42% male students. The average attrition rate prior to the study was 44 %.

Fourteen individuals completed the study, 12 females and 2 males with ages in the following ranges: four in their 20's, three in their 30's, two in their 40's, four in their 50's and one in her 60's. Their technical careers included: Preschool Education (3), Information Systems and Networks (1), Logistics Administrations (2), Human Resources Administration (2), Pharmacy (3), Social Work (1), General Accounting (1).

3.2 Research design

Table 2 illustrates the various overlapping phases of the study and the tools used to collect the data in each phase. Prior to conducting the present inquiry, a series of changes to program ID's that reflected contemporary learning theories and 21st century goals had been put in place across the institution (Charbonneau-Gowdy and Galdames, 2021). Essentially the changes to the ID of the programs involved changes as well to both technology tools and pedagogical practices that included: a) adding synchronous videoconferencing sessions in all courses for building learning communities; b) providing increased opportunities and resources for student collaboration on both learning assignments/projects and assessment processes; c) using group project-generated media as course content ; d) incorporating forums, padlets and career-designated community sites into courses for students to exchange ideas and opinions; e) creating separate institution-wide faculty and student online community sites.

In the first phase of the study, during March 2022, all incoming students were solicited to participate in the study. From that mailout, 16 students agreed to take part. Written ethical consent was gathered from each of these individuals once the institution had given formal permission for one of the co-author researchers, herself an administrator in the institution, to conduct the inquiry.

In the second phase of the study, extending from April to June 2022, the co-researcher met with the participants for the first interview. In this initial semi-structured group interview, background information – both professional and personal, especially pertaining to earlier education experiences, were discussed. The six interviews were conducted bi-weekly, transcribed and translated. Written reflections prepared by each participant and submitted to the co-researcher prior to their meetings were used as the basis of discussion for the following five interviews. In these reflections, participants summarized their ongoing transition into their respective technical program areas – both the highlights of their experiences and any challenges they were encountering. During this period, observations of digital activity in the forums and engagement in videoconferencing sessions were

conducted. Notes were kept by the co-researcher in a reflective journal to record any changes displayed by participants in terms of their identities and practices in these settings.

In the third phase, in July 2022, a final interview was conducted with participants (*n=14*). This discussion centred not only on their ongoing program experiences, but also any changes they perceived in their learning practices. This information was used to substantiate observations of levels of engagement being gathered from other data sources. In this period, for example, the co-researcher attended videoconferencing classes to observe participants in action. In this phase as well, faculty (*n=9*) who worked with the cohort of all new students provided feedback and comments on their experiences with and observations of these incoming students over the 5-month period.

Table 2: Phases of the study and data collection

Phases of the study	Data Tools	Description of Data
Phase 1 March 2022 **Gaining Access**	Field notes	-E-mail soliciting volunteers (*n= 120*) Institutional documents (enrolment figures, policy, attendance records)
Phase 2 April – June 2022 **Gathering Data**	Interviews	-Eight, 60-75-min. bi-weekly focus group interviews (*n= 6 per focus group);* 10 hours -Twenty, 30 to 40-min. individual interviews (*n=20*); 12 hours
	Questionnaires	-Participants' reflective journals – highlights and challenges (*n=54*)
	Field Notes	-Reflective journal - researcher -Digital activity - 12 online forum sessions
Phase 3 July 2022 **Analysis**	Interviews	-Two, 60—75 min. focus group interviews (*n=5-6);* 2 hours -Seven, 40-minute individual interviews (n=7); 5 hours -Whole group interview (*n=12*); 1.5 hours
	Observations	Observations of 3 synchronous videoconferencing classroom sessions
	Field Notes	Feedback from faculty (*n=9)* on students' progress

3.3 Data collection and analysis

Data was analyzed using grounded qualitative coding methods in a combined inductive-deductive process (Miles et al., 2014). Through this rigorous process, we sought to enhance the trustworthiness of the findings. After establishing a conceptual framework, a series of iterative steps were taken including: i) inspecting data sets for data to inform the research questions; ii) multiple readings and considerations of data sets; iii) condensing and coding data for key concepts and ideas that related to the theoretical framework and literature review; iv) identifying and refining salient or common themes from coded data; v) forming a conceptual framework that could be corroborated by findings.

4. Analysis and discussion of findings

Although many Chileans suffer from the inequities of a discriminatory educational system, recent government efforts to resolve these issues have been evident. One such effort is the fully subsidized opportunity offered to citizens working in technical areas to return to higher education institutions to upgrade their skills**.** This opportunity is considered by many as a means to rewrite their lives and gain the knowledge, experience and skills that will equip them for the global work settings in which they can better compete and hopefully prosper**.** Many who seize this opportunity initially envision the logistical demands of time and energy in returning to study as a major hurdle. Yet, many soon realize that despite their determination to succeed, misgivings and feelings about themselves as learners create more daunting barriers. Falsafi and Coll (2011, p.1) conceptualize these feelings as one's learner identity (LI) which "can be understood as an analysis process by which people come to give meaning to [their] participation in learning activities through the recognition of [themselves] as learners and the values and emotions that accompany this recognition".

In analyzing the data, especially from the early phase, the influence of the LIs that participants had constructed in their former educational lives factored importantly into their feelings about themselves as they entered their programs. Two themes surfaced in the thematic analysis process that conceptualize the identity trajectories many experienced over the 3 to 4-month period in the program: 1) LIs on entering the online program 2) LIs being reconstructed through social learning online environments.

4.1 Learner identities on entering the online program

LI, or the perception of oneself as a learner, is developed based on a subjective experience and dependant on the quality of interactions with others and resources (Julio-Maturana, 2017) in a learning context. Many participants testified to those perceptions in recounting the kinds of interactions they were confronted with in their earlier education.

For some participants, their earlier images as learners are reflected in the label that they attached to themselves - "*not a good student*". In our analysis, we uncovered roots of this label in their interactions with materials, assessment and teachers during past experiences in classrooms. Martin, for example, emphasized the fact that his grades acted as the defining influence on his view of himself as a student. He recounts: *"I didn't like it. I was not even very good at grades, I was always between a 5.0 and 5.5, tops. But I passed (passing the course), that was the important thing"* (Group interview, April, 2022). Here, Martin reveals his estimation of himself as a student. Rather than being focussed on learning, in previous schooling his goal was simply on achieving a passing grade and finishing his mandatory academic career. Like many Chileans for whom academic grades are a national obsession and a benchmark of one's worth, in Martin's eyes, his LI can be described as unmotivated and ambivalent about the value of learning. His comments echoed by other participants revealed that his teachers were boring, the majority of whom relied on rote teaching practices. His systematic low grades, indicative of his distancing himself from the efforts needed for achievement, led to his resignation in accepting his LI as "*not a good student*".

Leo described himself similarly as a poor student. In his case, Leo revealed that he lacked effective study skills and faced socio-economic challenges that interfered with his learning. He explained: *I was never really good at studying... I didn't stand out much in my studies either... And well, a poor family in the 80's was complicated, there were many problems, many social problems, work problems, which also influenced my school performance".* (Group interview, April, 2022) Leo recognizes his marginalized LI – an average student, indistinguishable from others in his achievements. He attributes his low-achieving, lackluster student identity to the multiple socio-economic contextual realities in which he was living. Through the lens of sociocultural theory, within these contextual boundaries that intersect with one another exist multiple layers of influence on learners' identities.

Maria's reservations and angst as an incoming student also reflect negative learning experiences in the past that impacted her LI. She shared: *"I feel insecure too, because even though I am a bit crazy... I still have that insecurity, those fears of knowing if I can continue or not, well, that is on the way... besides, studying online is new"*. Although not referring directly to her early schooling, the influence on her view of herself as a learner is ever-present - unsure of her abilities to continue, especially in an online space. Maria's fears of inadequacies in this new digital learning context reflect the power imbalances that Bourdieu contends (1998) exist in all learning contexts and that depending on how her LI evolves will determine her future destiny in the program and thereafter.

In contrast to Martin, Leo and Maria, a few participants spoke of themselves as "good students". The reasons for the identity labels they attached to themselves were revealed as the stories of their earlier schooling were pursued. Rocio's testimonies, for example, provide insight into the source of this alternative LI view. She attested to seeing herself as "a good student". Yet, eventually, personal and financial circumstances prevented her from building on the positive images she once held of herself as a learner and forced her to abandon her studies and find employment. Her stories are reminsiscent of many in deprived socio-economic conditions, in Chile and eslewhere, whose potential for development are thwarted by societal inequities. Rocio speaks poignantly about her loss of opportunity earlier in her life:

> *The truth is that I was a very good student.... I had good teachers, I had good grades...I studied at the high school, up to fourth grade [final year of secondary school] and I had my daughter, and well, my parents were separating, and the process was very complicated; and therefore I had to start working to support my daughter at that time. (Interview, April, 2022)*

Rocio ties her sense of self as a 'good student' to the identities of others, that of her teachers – who in her eyes were effective, and to her own as a learner - hard working, diligent and successful. Circumstances, both seemingly unexpected, interrupted her plans for advancing her studies. Despite her intentions, contextual

factors beyond her control acted as powerful deterrents in her formal learning process and denied her the opportunity to prove herself through further education.

Through the lens of identity theory, the data revealed that virtually all participants – the 'not good student' and those labeling themselves as a 'good student' on entering their online programs, were burdened with feelings of inadequacy as learners that endured from early schooling years. For Leo, Martin and María, the "not good students", their LIs were tied to failing to measure up at school, from a lack of motivation due to ineffective teaching practices, disinterest, fears, insecurities, and socio-economic issues. And even for individuals like Rocio who attested to being 'a good student', feelings of regret and unfulfillment due to their sociocultural and economic challenges, marked their LIs and left them fearful that further uncontrollable circumstances might once again prevent their proving themselves academically.

4.2 Identities being reconstructed through social learning online environments

Feelings of inadequacy and insecurity as learners permeated the early data. Yet, there were also signs of determination to escape such labels and to prove oneself. Laura remarks: *"I made the decision to take up studying again, more than anything else to see what I am capable of"* (Interview April, 2022). As Weedon's (1987) notion of identity explains, individuals are diverse, contradictory, dynamic and changing throughout historical time and social space.

Our analysis revealed various features of the online program precipitated this dynamic process in LI construction. Resources like the reflective forums and practices involved in collaborative group work led participants to interact regularly and systematically with their peers and teachers. Participants highlighted these interactive spaces as locations where they developed or enhanced their skills and generated greater security and confidence in their abilities. Signs of empathy for and support of their peers and active co-construction of knowledge in these forums were uncovered. The reconstruction of their LIs to more empowered and confident ones, most noticeably among those who initially recognized themselves as "not so good students", was evident both in data from participants and from the observations of faculty. Figure 3 illustrate two representative data excerpts to substantiate this analysis.

Data Evidence of Identity Transformations in Online Practice
INES: *Collaborative work helps us a lot to always be like, I don't know, like one of us is always in charge as a leader, so it is very useful for us to communicate our things. We always do collaborative work for group work, we always try to give our opinions, brainstorm ideas and that is very useful for us, to organize ourselves. We always divide up the tasks and that is something that I find works best in teamwork and in the thematic forums as well. I find that it is a very good thing, because many ideas are put forward and everyone has different points of view. So it also helps us to see things from a different perspective.* (Interview, Inés, June 2022)
MARTIN: *In the forum at the beginning, it was very difficult for me to describe things, and to express myself... then when interacting with my classmates and receiving feedback from the teachers, one becomes more confident... now, I feel more prepared, more prepared, with more tools, for example, in the forums I am very participative... I find, for my part, that one is more confident. First of all, the first videos, for example, I recorded the one on preparation a thousand times looking for perfection, but as time goes by, one has more self-confidence, sitting in front of a camera and answering questions. All of that.* (Interview, Martin, June 2022)

Figure 3: Evidence of identity transformations

For Inés, active group work and forum spaces were instrumental for her mediating an identity marked by confidence and leadership as well as teamwork skills - collaboration, communication of and openness to ideas, creative thinking and organization. Her collective use of the word "we" suggests that these skills and competencies were not exclusive to her but rather to others both in the research group and more broadly among other newcomers in programs. Martin's testimonial echoes similar sentiments of changes to his identity in the online spaces – new confidence from interacting and communicating with peers, engaged, invested in learning, determined, creative and open to challenges. Both testimonials as well as those from others are framed by the components in Engell and Coll's (2021) model (See Figure 2) that emphasize the key social and contextual influences on learner identity mediation. The transitions in LI uncovered in the analysis are summarized in Figure 4.

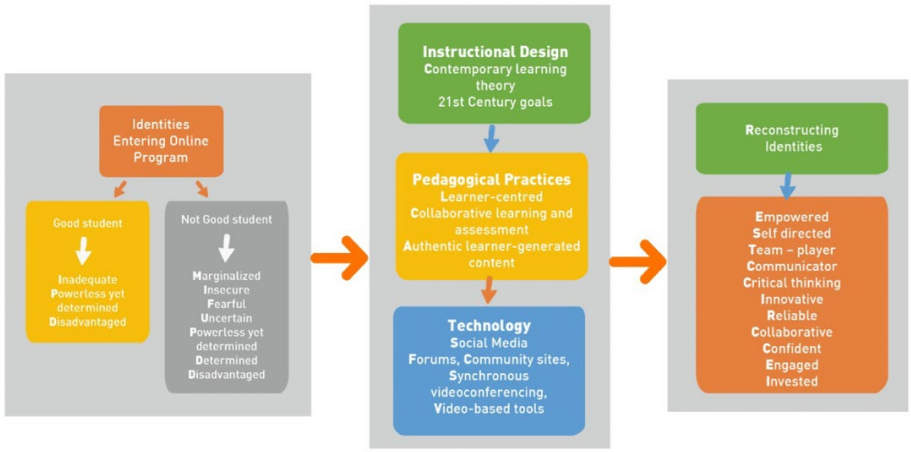

Figure 4: Identity transformations in aligning pedagogy, design and practice

Importantly, nowhere in the data were there signs of loss of interest, discouragement nor feelings of being overwhelmed - typical cues in HE contexts of a potential for abandonment of a program, a disturbingly typical reality in many distance learning contexts (Siemans, 2015).

5. Conclusion

The solid evidence reported here combined with that from the larger pedagogy/design/technology aligned initiative (Charbonneau-Gowdy and Galdames, 2021) provide insights into the power of multi-level institutional efforts for influencing human development. The impressive transitions that were evidenced in these individuals reflected emerging, empowered, confident, self-directed learner identities with evolving skills - teamwork, innovative and critically thinking and effective communicators, that project well for their present and future work worlds. Based on the solid data that was generated, clearly this development cannot be attributed solely to decisions on the part of the participants to further their education, but the result of enriched opportunities for development in this unique learning context. Opportunities for community building and shared knowledge construction were offered in videoconferencing synchronous sessions and institutionally organized career blogs, in the critical thinking involved in interacting in forums, in shared group work and socially-constructed assessment and feedback practices, and in digital, including video, content generating. These enriched opportunities for professional and personal development did not occur due to the institution simply reassessing and rewriting their overall learning policies, nor through *macro* level administrators installing top-down directives to *meso* and *micro* level practitioners to alter their pedagogical practices and their use of technology. The opportunities the participants enjoyed are the result of a combined multi-level dialogic effort to match contemporary social learning principles and 21st century theoretical goals with cross-program instructional designs that guide pedagogical practices that are supported by powerful social media tools (Charbonneau-Gowdy and Chavez, 2019; Charbonneau-Gowdy and Galdames, 2021). We acknowledge that stories of positive identity transformations uncovered in these findings cannot be generalized to the entire student body, nor indeed across all e-learning sites. We also recognize that the size of the study and number of participants is limited, and a longer timeline could have added to the authority of our results. Yet, along with calls for similar large-scale, cross-institutional approaches in e-learning research (Zhang et al., 2020), especially in light of what we as a society have recently experienced in the move to online education, we believe our findings support the search for theoretically based, practical global solutions to the challenges we all face going forward.

References

Aina, C. Baici, E., Casalove, G., and Pastore, F. (2021) "The Determinants of University Dropout: A Review of the Socio-economic Literature", Socio Economic Planning Sciences, [online] doi.org/10.1016/j.seps.2021.101102 .

Baxter, P. and Jack, S. (2008) "Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers", *The Qualitative Report*, Vol 13, No. 4, pp. 544-599.

Bourdieu, P. (1998) *Acts of Resistance: Against the New Myths of Our Time*, Polity Press, Cambridge.

Charbonneau-Gowdy, P.and Galdames, C. (2021). **"**Connecting the Dots: Putting Instructional Design Theory to Practice in Online Courses". *Proceedings of the 20th International Conference on e-Learning,* (ECEL, 2021)**,** University of Applied Sciences HTW**,** Berlin, Germany**,** pp**.** 80-88.

Charbonneau-Gowdy, P. and Chavez, J. (2019). "3-M Model for Uncovering the Impact of Multi-level Identity Issues on Learners' Social Interactive Engagement Online", *Electronic Journal of e-Learning* Vol 17, No. 2, pp. 131-143.

Creswell, J. (2007). *Five Qualitative Approaches to Inquiry in Qualitative Inquiry and Research Design* (2nd ed), Sage Publications, California.

Darvin, R. and Norton, B. (2015) "Identity and the Power of Investment in Applied Linguistics", *Annual Review of Applied Linguistics*, Vol 35, pp. 36–56.

Denzin, N.K., and Lincoln, Y.S. (2018) Introduction: The discipline and practice of qualitative research. In N.K.

Denzin and Y.S. Lincoln (Eds.), *The Sage Handbook of Qualitative Research* (2011 ed.), Sage,Thousand Oaks.

Engell, A. y Coll, C. (2021) "La Identidad de Aprendiz: El Modelo de Coll y Falsafi", *Papeles de Trabajo sobre Cultura, Educación y Desarrollo Humano*, Vol 17, No. 1, pp. 1-12.[online] http://psicologia.udg.edu/PTCEDH/menu_articulos.asp

Falsafi, L. and Coll, C. (2011) "La Construcción de la Identidad de Aprendiz: Coordenadas Espacio-temporales" En J. I. Pozo y C. Monereo (Coords.). *La Identidad en Psicología de la Educación: Necesidad, Utilidad y Límites,* 77-98.

Narcea, Barcelona. [online] http://psyed.edu.es/archivos/grintie/Falsafi_Coll_ConstruccionIdA_2011.pdf

Garrison, D. R., Anderson, T. and Archer, W. (2000) "Critical Inquiry in a Text-based Environment: Computer Conferencing in Higher Education Mode" *The Internet and Higher Education*, Vol 2, No.2-3, pp. 87-105.

Gruba, P., Cárdenas-Claros, M. Suvorov, R. and Rick, K. (2016) *Blended Learning Program Evaluation*, Palgrave Macmillan, London.

Harasim, L., 2012. *Learning Theory and Online Technologies,* Routledge/Taylor & Francis, New York.

Julio-Maturana, C. (2017) "Configurando Identidad de Aprendiz en la Escuela: Obstáculos en la Relación Pedagógica y su Incidencia en Procesos de "Deserción" Escolar Temprana", *Revista Latinoamericana de Educación Inclusiva,* Vol 11, No. 1, pp. 109-129. [0nline] https://dialnet.unirioja.es/servlet/articulo?codigo=5979538.

Margaryan, A., Bianco, M. and Littlejohn, A. (2015) "Instructional quality of Massive Open Online Courses (MOOCs)", *Computers and Education*, Vol 80, pp. 77-83.

Miles, M. B., Huberman, A. M., and Saldaña, J. (2014) *Qualitative Data Analysis: A Methods Sourcebook* (3rd ed.). Sage, London.

Pange, A. and Pange, J. (2011) "Is e-Learning Based on Learning Theories? A Literature Review", *International Scholarly and Scientific Research and Innovation*, Vol 5, No. 8, pp. 932- 936.

Picciano, A. G. (2017) "Theories and Frameworks for Online Education: Seeking an Integrated Model" *Online Learning*, Vol 21, No. 3, pp. 166-190.

Rientes, B. and Toetenel, L. (2016) "The Impact of Learning Design on Student Behaviour, Satisfaction and Performance: A Cross-institutional Comparison Across 151 Modules", *Computers in Human Behaviour*, Vol 60, pp. 333-341.

Rosenberg, J.S. (2021) "The Future of Teaching: Pilot Program Points to the Potential of Hybrid Instruction", *The Harvard Review*, July-August, 2021. [online] https://www.harvardmagazine.com/2021/07/jhj-harvard-teaching

Siemens, G., Gasevic, D., and Dawson, S. (2015) "Preparing for the Digital University: A Review of the History and Current State of Distance, Blended, and Online Learning" [online] https://linkresearchlab. org/PreparingDigitalUniversity.pdf

Siemens, G. (2004) "Connectivism: A Learning Theory for the Digital Age". [online] http://www.elearnspace.org/Articles/connectivism.htm

Weedon, C. (1997) Feminist Practice and Poststructuralist Theory, Blackwell, London.

Zhang, L., Carter Jr, R. A., Qian, X., Yang, S., Rujimora, J. and Wen, S. (2022) "Academia's Responses to Crisis: A Bibliometric Analysis of Literature on Online Learning in Higher Education During COVID-19", *British Journal of Educational Technology,* Vol *53*, No. 3, pp. 620-646.

The Relative Importance of Digital Competences for Predicting Student Learning Performance: An Importance-Performance Map Analysis

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Abstract: Today's higher education learning environment expects students to have such digital skills as navigating a learning management system, using word processing or presentation software, and searching for online information. The widespread use of digital technology in teaching and learning has necessitated a need for students to be digitally competent in order to perform well in their studies. However, different types of digital competence may be necessary at different stages of the students' learning journey, and some digital competences may be more essential to students' academic performance than others. To identify the digital competences that students perceive to be most important for their learning performance, and to determine students' perception of their level of performance in these digital competences, this study adopted the Digital Competence Framework for Citizens 2.2 (DigComp) to design a survey questionnaire and collect responses from university students. An importance-performance map analysis (IPMA) was conducted to examine the relative importance of each of the five digital competence areas and the 21 digital competences identified in DigComp, as well as how each performs in relation to the others, in predicting student learning performance. Study findings revealed that the problem solving competence area was perceived to be the most important for student learning performance, followed by information and data literacy, and communication and collaboration. The respondents did not perceive the digital content creation and safety competence areas as important for their learning performance. The study findings also found that the respondents differed in their perception of how well they were performing in these competence areas. Using DigComp as a point of departure, this study makes a novel attempt to determine the relative importance of each of the five digital competence areas and 21 digital competences identified in the framework, as well as how each one compares to the others in performance when it comes to predicting how well students will perform in their learning.

Keywords: DigComp, digital competences, digital skills, higher education, importance-performance map

1. Introduction

From primary and secondary schools to universities, today's students are utilising digital technology to varying degrees in their learning. In addition to searching for information on the web, students learn to use a variety of computer hardware, software, and telecommunication technologies, such as digital devices (e.g., computers, smartphones), productivity software (e.g., Google Docs Editors, Office 365), messaging apps (e.g., WhatsApp, Telegram), learning management systems (e.g., Moodle, Blackboard), and so on. The role of digital technology has become even more significant during the COVID-19 pandemic when learning was delivered online because of large-scale school closures.

Students must possess the necessary digital competences in terms of knowledge, skills, and attitudes to effectively use digital technology for learning (Vuorikari, Kluzer and Punie, 2022). The levels of students' digital competence vary depending on their prior experience with digital technology and how they apply that technology in their learning. Students may need to go beyond basic usage of digital technology to achieve higher proficiency levels because digital competence is multi-faceted and includes topics such as information and data literacy; communication and collaboration; media literacy; digital content creation; safety; intellectual property; problem solving; and critical thinking (European Commission, 2019). Knowing how to send a text message and conduct a web search will not suffice to improve academic performance.

This study adopted the Digital Competence Framework for Citizens 2.2 (DigComp) (Vuorikari, Kluzer and Punie, 2022) to design a survey questionnaire and collect responses from university students at a local university. Specifically, an importance-performance map analysis (IPMA) was conducted to examine the importance of each of the five digital competence areas and 21 digital competences, and how they compare to each other in predicting how well students will perform in their learning.

The study findings may help educational institutions, educators, and students to improve students' learning performance by helping them to identify and prioritise digital competences that are important but have a low performance level. The study findings may also help educational institutions and educators identify competence gaps, which would enable them to devise action plans to help students develop their digital competence and proficiency.

The remainder of this paper provides a background to the research, explains the research design and method, presents the data analysis results, and concludes with a discussion of the study findings.

2. Research background

2.1 Digital competence

Digital competence is a broad concept with multiple dimensions (Ilomäki et al., 2016), involving not only the effective use of digital tools but also digital behaviours (e.g., communication, teamwork) and digital mindsets (e.g., lifelong digital learning) (Martzoukou et al., 2021). Digital competence is a mix of knowledge, skills, and attitudes that can be developed throughout life in both formal and informal learning settings (European Commission, 2019).

Another concept that is frequently used interchangeably with digital competence is digital literacy (Ilomäki et al., 2016). While digital literacy refers to the technical skills of using digital tools from a technical perspective, digital competency is a broader concept involving a socio-cultural perspective of the knowledge, capabilities, and dispositions that individuals and society need to be successful in the digital age (Falloon, 2020).

To examine the synonymous use of the digital competence and digital literacy concepts, Spante et al. (2018) conducted a systematic review of articles in higher education research. They reported that the use of the concepts varies based on such characteristics as regions (e.g., US or Continental Europe), disciplines (e.g., health or teacher education), research aims (e.g., developing educational systems or developing student competence), and research focus (e.g., macro at societal level or micro at student level).

The development of DigComp is based on the European Commission's definition of digital competence, which states:

> *Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking (European Commission, 2019, p. 10).*

As digital competence is one of the key competences for lifelong learning (European Commission, 2019), it may be advantageous for students to begin acquiring digital competence in primary school and for teachers to use appropriate pedagogical practices to support students and prepare them for the digital age (Pöntinen and Räty-Záborszky, 2020). Ilomäki et al. (2016) suggest that being able to use and apply digital technologies should be embedded in all learning and teaching. Learning these skills requires practising them through complex, challenging, and authentic learning activities.

2.2 Digital Competence framework for citizens (DigComp)

DigComp was developed to help people in the European Union assess their digital competence for learning, working, and societal participation purposes. It also helps in decision-making and the formulation of digital policy and strategy. DigComp has gone through several iterations, i.e., DigComp 1.0 in 2013, DigComp 2.0 in 2016, DigComp 2.1 in 2017, and the latest DigComp 2.2 in 2022 (Vuorikari, Kluzer and Punie, 2022).

DigComp identifies 21 digital competences that are grouped into five key competence areas, i.e., information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. These digital competences indicate the knowledge, skills, and attitudes that are needed to use digital technology well.

DigComp is organised into five dimensions: (1) Dimension one identifies the five digital competence areas; (2) Dimension two describes each of the 21 digital competences; (3) Dimension three details the proficiency levels of each competence; (4) Dimension four provides examples of knowledge, skills, and attitudes relevant to each competence; and (5) Dimension five provides some use cases.

3. Research design and method

3.1 Construct operationalisation

To operationalise the constructs, this study adopted DigComp's 21 digital competences that are grouped into five key competence areas, i.e., information and data literacy, communication and collaboration, digital content creation, safety, and problem solving (Vuorikari, Kluzer and Punie, 2022). Notably, each digital competence can have eight levels of proficiency, from being able to perform simple tasks to solving complex problems. In a way, it is very similar to moving up Bloom's cognitive hierarchy from remembering, understanding, applying, and evaluating, to creating (Anderson and Krathwol, 2001).

As the target respondents of this study were bachelor's degree students at a local university, to measure their proficiency level for each digital competence, this study adapted proficiency level five (i.e., applying), with the expectation that as undergraduate university students, the respondents are supposed to be able to perform different tasks and solve different problems, as well as guide others. To measure perceived learning performance, five self-developed items were used. Table 1 presents a summary of the operationalisation of the constructs.

Table 1: Operationalisation of the constructs

Construct	Indicator Code	Indicator Description	Mean	SD	Outer weigh t	P value
Information and data literacy	Info_1	I can use search engines and their search functions to search for digital data, information, and content.	3.79	.946	0.383	<0.001
	Info_2	I can evaluate the credibility and reliability of different digital data, information, and content.	3.51	.876	0.369	<0.001
	Info_3	I can manage digital data, information, and content for easier organisation, storage, and retrieval.	3.62	.905	0.363	<0.001
Communication and collaboration	Comm_1	I can use a variety of digital technologies to interact with others.	3.81	.923	0.187	<0.001
	Comm_2	I can share digital data, information, and content through a variety of appropriate digital tools.	3.75	.906	0.201	<0.001
	Comm_3	I can participate in society as a citizen through the use of public and private digital services.	3.64	.919	0.213	<0.001
	Comm_4	I can propose different digital tools and technologies for collaborative purposes.	3.54	.929	0.195	<0.001
	Comm_5	I am aware of different behavioural norms and know-how while using digital technologies to interact with others in a digital environment.	3.60	.928	0.202	<0.001
	Comm_6	I can use different ways to protect my reputation online.	3.57	.920	0.170	<0.001
Digital content creation	Create_1	I can use different ways to create and edit content in different formats.	3.57	.951	0.290	<0.001
	Create_2	I can modify, refine, improve, and integrate digital information and content to create new, original and relevant content and knowledge.	3.49	.960	0.317	<0.001
	Create_3	I can use different rules of copyright and licenses that apply to digital data, information, and content.	3.43	.984	0.257	<0.001

Construct	Indicator Code	Indicator Description	Mean	SD	Outer weigh t	P value
	Create_4	I can operate, with the help of instructions, a computing system to solve different problems or perform different tasks.	3.54	.894	0.291	<0.001
Safety	Safety_1	I can use different ways to protect devices and digital data, information, and content.	3.46	.936	0.306	<0.001
	Safety_2	I can use different ways to protect my personal data and privacy in a digital environment.	3.52	.940	0.266	<0.001
	Safety_3	I know how to avoid health-risks and threats to physical and psychological well-being while using digital technologies.	3.56	.931	0.287	<0.001
	Safety_4	I can show different ways to protect the environment from the impact of digital technologies and their use.	3.43	.974	0.295	<0.001
Problem solving	Problem_1	I can use different solutions to technical problems in a digital environment and operating digital devices.	3.41	.949	0.283	<0.001
	Problem_2	I can use different digital tools and possible technological solutions to solve personal needs.	3.56	.892	0.299	<0.001
	Problem_3	I can use different digital tools and technologies to create knowledge and innovative processes and products.	3.45	.969	0.263	<0.001
	Problem_4	I am aware of specific aspects in my digital competence that need to be improved on or updated.	3.50	.953	0.289	<0.001
Perceived learning performance	Perform_1	My current overall level of digital competence is sufficient for me to acquire new knowledge.	3.65	.834	0.229	<0.001
	Perform_2	My current overall level of digital competence is sufficient for me to improve my academic performance.	3.64	.804	0.239	<0.001
	Perform_3	My current overall level of digital competence is sufficient for me to complete my assignments better.	3.69	.764	0.235	<0.001
	Perform_4	My current overall level of digital competence is sufficient for me to enhance my ability to learn new things.	3.71	.777	0.220	<0.001
	Perform_5	My current overall level of digital competence is sufficient for me to overcome academic challenges.	3.61	.828	0.220	<0.001

3.2 Data collection

A survey instrument was designed to collect data in an online questionnaire survey. The questionnaire consisted of eight sections. Section A asked questions about the learning of digital skills. Sections B to F asked questions about digital competence proficiency. All items were measured using a five-point Likert-type scale, with 5 being "very proficient" and 1 being "not proficient at all." Section G asked about learning performance. All items were measured using a five-point Likert-type scale, with 5 being "strongly agree" and 1 being "strongly disagree." Section H asked several demographic questions.

Bachelor's degree students at a local university were invited to voluntarily complete the online survey questionnaire anonymously. The data collection lasted about three weeks and received a total of 314 responses. A check was performed for multivariate outliers. Using the rule that a response is considered an outlier if the probability of its squared Mahalanobis distance is equal to or less than 0.001 (Tabachnick and Fidell, 2007), there were no outliers and zero responses were removed. Thus, 314 valid responses were retained for further data analysis.

All the 314 respondents were students studying such majors as accounting, business administration, logistics management, marketing, and so on. Of these respondents, 167 (53.2%) were female and 147 (46.8%) were male. Their average age was 20.96 years old, with a minimum age of 18 and a maximum age of 29. In order of frequency, 76 of them (24.2%) were currently in semester 6 or later, 72 (22.9%) in semester 3, 55 (17.5%) in semester 2, 47 (15%) in semester 4, 36 (11.5%) in semester 5, and 28 (8.9%) in semester 1.

The majority of the respondents reported that they obtained their knowledge and skills to work with digital technology from websites (70.4% of the respondents), followed by classes at school (66.6%), YouTube videos (63.4%), friends (51%), and trial and error (30.6%). In order of frequency, 145 respondents (46.2%) agreed and 82 (26.1%) strongly agreed that learning digital skills should be a lifelong personal initiative. However, 34 respondents (10.8%) strongly disagreed and 4 (1.3%) disagreed, whereas 49 respondents (15.6%) somewhat agreed.

4. Data analysis and results

Data were analysed using SPSS for descriptive analysis and SmartPLS for importance-performance map analysis (IPMA). An IPMA can be performed on both the construct and indicator levels. There are two dimensions on an importance-performance map. The x-axis represents the importance dimension, which indicates the total effects of the constructs or indicators on the target construct. The higher the total effect, the more important a construct or indicator is for the target construct. The y-axis represents the performance dimension, which indicates the average rescaled latent variable scores for constructs or rescaled scores for indicators, rescaled to a range from 0 to 100. The higher the score is, the better a construct or indicator performs in relation to the target construct. An IPMA provides useful information that can be used to make decisions about the prioritisation of constructs or indicators by considering their relative importance and performance in relation to the target construct. The prioritisation decisions can assist in the improvement of the target construct (Ringle and Sarstedt, 2016).

Following the suggestion by Ringle and Sarstedt (2016), three requirements were first checked before performing the IPMA: (1) indicators are measured using a metric scale; (2) same scale coding direction; and (3) outer weights estimates must be positive. The measurement and coding of the indicators had already met the first two requirements. The bootstrapping results of 5,000 samples showed that all indicators had positive outer weights and were significant at a 95% significance level (see Table 1).

4.1 IPMA on the construct level

Table 2 indicates the importance and performance values of the constructs, i.e., communication and collaboration, digital content creation, information and data literacy, problem solving, and safety, in relation to the target construct, i.e., perceived learning performance.

Table 2: Importance and performance values of the constructs

Construct	Importance (Total effect)	Performance (Average rescaled LV score)
Communication and collaboration	0.139	66.255
Digital content creation	0.089	62.790
Information and data literacy	0.155	65.963
Problem solving	0.251	62.103
Safety	0.079	62.262

Figure 1 depicts the importance-performance map using a scatter chart based on the analysis results. The x-axis represents the importance of the constructs for explaining the target construct, while the y-axis represents the performance of the constructs in terms of their average rescaled latent variable scores.

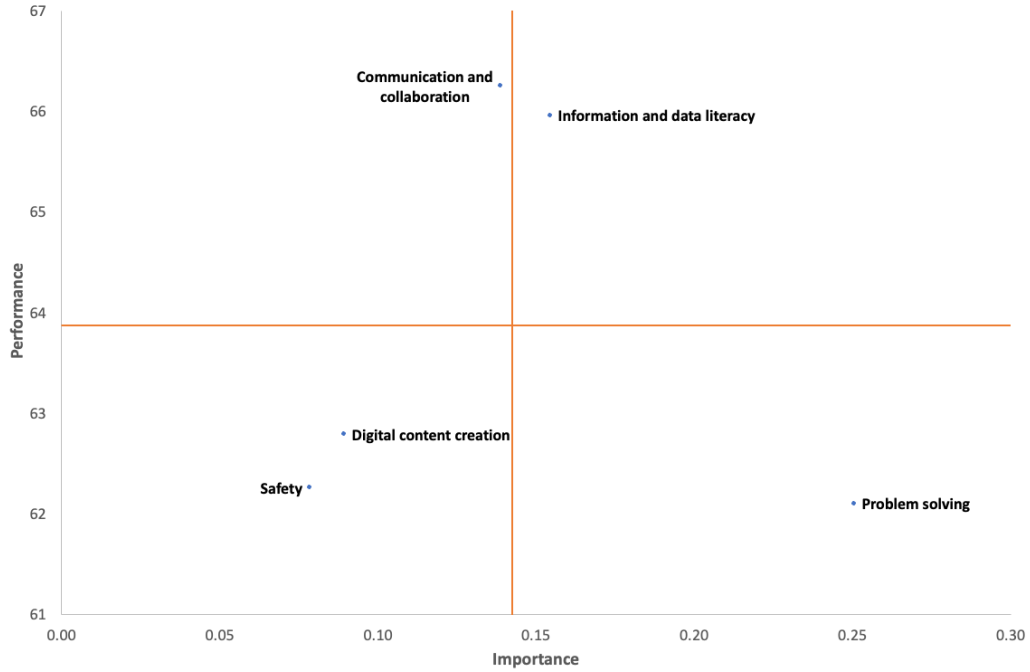

Figure 1: Importance-Performance map of constructs on perceived learning performance

The constructs, i.e., communication and collaboration, digital content creation, information and data literacy, problem solving, and safety, had an average importance value of 0.142 and an average performance value of 63.874. Figure 2 shows that the importance-performance map was divided into four quadrants with the plotting of the average importance value (vertical line) and average performance value (horizontal line). The four quadrants are: Quadrant 1 (above-average importance, above-average performance, known as "keep up the good work"); Quadrant 2 (below-average importance, above-average performance, known as "possible overkill"); Quadrant 3 (below-average importance, below-average performance, known as "low priority"); and Quadrant 4 (above-average importance, below-average performance, known as "concentrate here") (Hosseini and Ziaei Bideh, 2013). In terms of priority for making performance improvement for the target construct, Quadrant 4 is the top priority, followed by Quadrant 1, Quadrant 3, and Quadrant 2 (Ringle and Sarstedt, 2016).

Problem solving was in Quadrant 4. Problem solving has a below-average performance of 62.103 but an above-average importance of 0.251 relative to other constructs. This implies that a one-unit increase in the performance of problem solving from 62.103 to 63.103 would increase the performance of perceived learning performance by 0.251 points, from 66.538 to 66.789. As for other constructs, information and data literacy were in Quadrant 1, digital content creation and safety in Quadrant 3, and communication and collaboration in Quadrant 2.

4.2 IPMA on the indicator level

Table 3 indicates the importance and performance values of all the indicators of the constructs, i.e., communication and collaboration, digital content creation, information and data literacy, problem solving, and safety, in relation to the target construct, i.e., perceived learning performance. When the analysis is expanded to the indictor level, it is possible to determine which specific aspects of the construct are the most significant (Ringle and Sarstedt, 2016).

Table 3: Importance and performance values of the indicators

Indicator Code	Importance (Total effect)	Performance (Rescaled score)
Comm_1	0.022	70.223
Comm_2	0.024	68.710
Comm_3	0.025	65.924
Comm_4	0.023	63.376
Comm_5	0.024	64.968

Indicator Code	Importance (Total effect)	Performance (Rescaled score)
Comm_6	0.020	64.172
Create_1	0.022	64.331
Create_2	0.024	62.261
Create_3	0.019	60.828
Create_4	0.024	63.455
Info_1	0.051	69.745
Info_2	0.053	62.818
Info_3	0.051	65.446
Problem_1	0.062	60.271
Problem_2	0.069	64.092
Problem_3	0.056	61.226
Problem_4	0.063	62.500
Safety_1	0.021	61.465
Safety_2	0.018	62.898
Safety_3	0.020	63.933
Safety_4	0.019	60.828

Figure 2 depicts the importance-performance map using a scatter chart based on the analysis results. The x-axis represents the importance of all the indicators of the constructs, i.e., communication and collaboration, digital content creation, information and data literacy, problem solving, and safety, for explaining the target construct, i.e., perceived learning performance, while the y-axis depicts the performance of the indicators in terms of their rescaled scores.

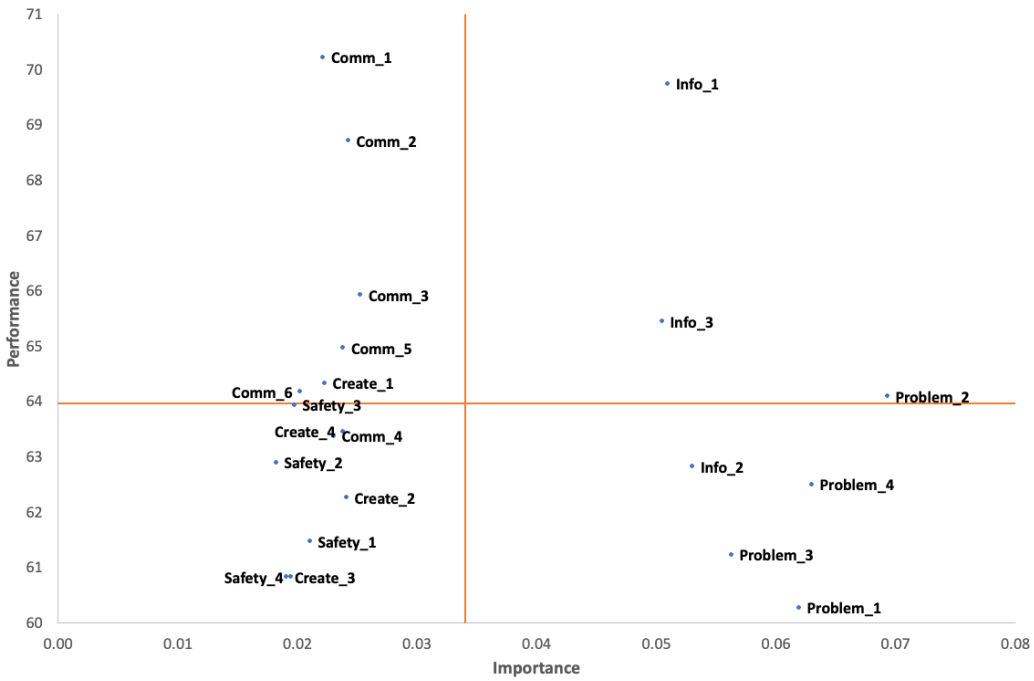

Figure 2: Importance-Performance map of indicators on perceived learning performance

The indicators had an average importance value of 0.034 and an average performance value of 63.975. Figure 2 shows that the importance-performance map was divided into four quadrants with the plotting of the average importance value (vertical line) and average performance value (horizontal line).

Four indicators, i.e., Info_2, Problem_1, Problem_3, and Problem_4, were in Quadrant 4. These indicators had a below-average performance of 62.818, 60.271, 61.226, and 62.500 respectively, but above-average importance of 0.053, 0.062, 0.056, and 0.063, respectively, relative to other indicators. This implies that a one-unit increase in the performance of Info_2, Problem_1, Problem_3, and Problem_4 would increase the performance of the

individual indicators of perceived learning performance by 0.053, 0.062, 0.056, and 0.063 points, respectively. As for other constructs, three indicators were in Quadrant 1, eight indicators in Quadrant 3, and six indicators in Quadrant 2.

5. Discussion and conclusion

It appears that school classes are not the only means by which the respondents learn about digital technology; when they needed to learn or had a question about digital technology, most of them searched for information on websites or YouTube videos. This may be because the respondents are in their early twenties and this generation is accustomed to using the web as a key source of information. The majority of them also agreed or strongly agreed that learning digital skills should be a lifelong personal initiative. This finding reflects the common understanding that people need to continuously learn as digital technology evolves (European Commission, 2019; Vuorikari, Kluzer and Punie, 2022). This is even more essential because of the rapid advancement and proliferation of technology, e.g., artificial intelligence, blockchain, and the current trend towards smart nations.

Regarding the digital competence areas, the finding shows that problem solving is relatively more important than communication and collaboration, digital content creation, information and data literacy, and safety for improving student learning performance. This seems to be reasonable because problem solving is mostly about selecting and using the right digital tools to meet personal needs and to create knowledge, innovative processes, or products; identifying and solving technical problems in the course of using these tools; and improving one's digital competence, and thus the problem solving competence area is essential for one's learning performance. However, the respondents perceived that their performance in this competence area was considerably lower than in any of the other four competence areas. Therefore, it may be helpful for future learning design and delivery to incorporate learning activities that can help students improve their problem solving capabilities.

The second and third most important competence areas for improving student learning performance are information and data literacy, and communication and collaboration. The respondents reported above average performance levels in these two competence areas. This reflects that the respondents are familiar with browsing, searching, filtering, evaluating, and managing data, information, and digital content. In addition, the respondents are also comfortable with interacting and sharing data, information, and digital content with others through digital technologies for communication and collaboration purposes. As information and data literacy is perceived to be above-average important for student learning performance, there is room for future learning design and delivery to further enhance students' information and data literacy. However, the respondents considered communication and collaboration to be of below-average importance for their learning performance. It may be reasonable to presume that the use of digital technologies for communication and collaboration purposes is taken for granted by the respondents as everyday activities, and they do not quite see how this can directly contribute to their learning performance.

It is interesting to note that the respondents considered digital content creation and safety to be of below-average importance to their learning performance, and they also did not think they were performing well in these two competence areas. Digital content creation mainly concerns creating and editing new original digital content in different formats with an understanding of copyright and license issues, whereas safety mainly concerns safeguarding digital devices, digital content, personal data, and privacy, as well as protecting health and the environment related to the use of digital technologies. This finding does not mean that digital content creation and safety are not important competence areas. It is possible that because DigComp was originally designed as a general assessment tool to be used in many different contexts, the respondents may not see a direct link between these two competence areas and their performance in the higher education context specifically.

On the indicator level, the findings are rather consistent with those of the construct level. Three problem solving and one information and data literacy competences are perceived to be of above-average importance for student learning performance. However, the respondents perceived that they performed below average in these competences. Notably, the respondents perceived the ability to evaluate the credibility and reliability of sources of data, information, and digital content as particularly important for their learning performance. This finding is significant given the enormous amount of information that is available on the web. Students need to be able to differentiate credible and reliable information from that which is not.

Two information and data literacy and one problem solving competences are above-average important for student learning performance, and the respondents perceived that they were performing above average in these competences. This finding points to the fact that being able to search for and manage data, information, and digital content based on information needs and to select and use digital tools to meet learning needs is essential for academic performance, and the respondents felt they were able to perform these tasks well. This finding supports the idea that an importance-performance analysis at the indicator level provides more useful information than one at the construct level. It also shows that although the respondents did not think they performed well on three other problem solving competences, they thought they performed better than average when it comes to selecting and using digital tools to meet learning needs.

The respondents reported that they performed above average on most of the communication and collaboration competences. This finding is to be expected because of the widespread use of digital tools among today's young generation for communication and collaboration purposes (e.g., social media, e-mail). This may be one reason the respondents are generally confident in their performance in these competences. Similar to the findings at the construct level, the importance of most communication and collaboration competences is relatively below average for student learning performance. Similar to the findings at the construct level, most of the digital content creation and safety competences are below-average important for student learning performance, and the respondents did not think they performed well in these competences.

In conclusion, this study provides an insight into the weaknesses and strengths of current learning design and delivery based on the importance of the 21 digital competences and how well the respondents think they were performing in these competences. If the respondents do not think they are doing well in any competences that are perceived to be of above-average importance, future learning design and delivery will need to improve these major weaknesses. On the other hand, if the respondents reported that they are performing well in any competences that are above-average important, future learning design and delivery will need to leverage these major strengths to further enhance student learning performance (Phadermrod, Crowder and Wills, 2019).

When aiming to enhance student learning performance, the study findings suggest that the top priority is to design learning delivery to help students improve their problem solving competences because these competences have a greater effect on student learning performance, but students do not seem to have a high level of proficiency in these competences. The second priority is to further improve their information and data competences, although the students already feel quite proficient in these competences. Although the finding shows that the digital content creation and safety competences are perceived by the respondents to play a less significant role in their learning performance, given the significance of these competences in digital societies and nations, the third priority is to help students gain a higher level of proficiency in these competences to better prepare them for their societal encounters. The fourth priority is to help students leverage their high level of proficiency in communication and collaboration competences for better learning performance.

Since the study was conducted in a local setting, the results may apply to other undergraduate students in a similar local setting, but they may not apply to other settings. Future research could perform a multigroup analysis to compare different groups of students in terms of education levels (e.g., primary, secondary, undergraduate, postgraduate), nations (e.g., Asian, European), programmes (e.g., business, computing, engineering), learning environments (e.g., face-to-face, blended, online), and so on to examine whether students differ in terms of the importance and performance of digital competences.

References

Anderson, L. and Krathwohl, D.A. (2001) Taxonomy for Learning, Teaching And Assessing: A Revision of Bloom's Taxonomy of Educational Objectives, Longman, New York.

European Commission (2019) Key Competences for Lifelong Learning, Publications Office of the European Union, Luxembourg.

Falloon, G. (2020) "From Digital Literacy to Digital Competence: The Teacher Digital Competency (TDC) Framework", Educational Technology Research and Development, Vol. 68, pp 2449-2472.

Hosseini, S.Y. and Ziaei Bideh, A. (2014) "A Data Mining Approach for Segmentation-Based Importance-Performance Analysis (SOM-BPNN-IPA): A New Framework for Developing Customer Retention Strategies", Service Business, Vol. 8 No. 2, pp 295-312.

Ilomäki, L., Paavola, S., Lakkala, M. and Kantosalo. A. (2016) "Digital Competence - An Emergent Boundary Concept for Policy and Educational Research", Education and Information Technologies, Vol. 21 No. 3, pp 655-679.

Martzoukou, K., Kostagiolas, P., Lavranos, C., Lauterbach, T. and Fulton, C. (2021) "A Study of University Law Students' Self-Perceived Digital Competences", Journal of Librarianship and Information Science, pp 1-19. doi:10.1177/09610006211048004.

Phadermrod, B., Crowder, R.M. and Wills, G.B. (2019) "Importance-Performance Analysis Based SWOT Analysis", International Journal of Information Management, Vol. 44, pp 194-203.

Pöntinen, S. and Räty-Záborszky, S. (2020) "Pedagogical Aspects to Support Students' Evolving Digital Competence at School", European Early Childhood Education Research Journal, Vol. 28 No. 2, pp 182-196.

Ringle, C.M. and Sarstedt, M. (2016) "Gain More Insight from Your PLS-SEM Results: The Importance-Performance Map Analysis", Industrial Management & Data Systems, Vol. 116 No. 9, pp 1865-1886.

Spante, M., Hashemi, S.S., Lundin, M. and Algers, A. (2018) "Digital Competence and Digital Literacy in Higher Education Research: Systematic Review of Concept Use", Cogent Education, Vol. 5 No. 1, pp 1-21.

Tabachnick, B.G. and Fidell, L.S. (2019) Using Multivariate Statistics (7th ed.), Pearson, Boston.

Vuorikari, R., Kluzer, S. and Punie, Y. (2022) DigComp 2.2: The Digital Competence Framework for Citizens, Publications Office of the European Union, Luxembourg.

How to Design Virtual Video Production for Augmented Student Presentations

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Abstract: E-learning environments have been developed and used by teachers and learners for decades. However, it is well known that sending, recording or meeting online can have a lack of presence and immersion. Furthermore, the configuration of a studio environment typically depends on physical props and technologies, which can be time consuming and hard to use for teaching purposes where each session may need a different configuration. Virtual Video Production (VVP) is a relatively new technology that builds on advances in extended reality (XR), supported by game engines and computer-controlled camera equipment. Camera data (pan, tilt, zoom, position) can be sent to a virtual camera in the game engine. The scene can be rendered via a green screen or with large LED displays. This provides an immersive presence with virtual 3D objects positioned in the room. Light settings can be mixed into the scene with remote control of LED lights to be in sync with virtual lights. Thus, VVP opens many opportunities for more immersive e-learning experiences. The challenge is how to apply these opportunities that involve syncing of several technical components and layers, designed to be useful within limited course resources. The question in this paper is how VVP can be designed and set up in an easy way for teachers and students to use it for presentations in courses? This paper presents results from a course in Immersive Environments where students first developed mobile Augmented Reality app prototypes and then used VVP to present their final work together with the authors. The authors documented preparation, wrote instructions for students and observed with notes taken during recording sessions. The results show how VVP can be designed and set up for course presentations that goes beyond a plain video recording in a lecture room or at home, but also beyond what was previously possible in a video studio at the university. This includes e.g., technical setup, direction of students, synopsis, concepts and virtual 3D props. Finally, the authors draw conclusions of what challenges remain for future research and suggestions of how to overcome them.

Keywords: technology-enhanced learning, extended reality, method, immersion, video production

1. Introduction

Virtual video production (VVP) has its roots in machinima (machine-cinema) where computer games and game technologies are used to produce videos, but also traces back to the so called ‘demoscene’ in the eighties to show off what is feasible to do with graphics and music on computers. (Harwood & Grussi, 2021). This paper first gives a background to early and current research efforts in this field, before presenting our own work with findings based on implementing virtual video production techniques in a video studio on campus. Finally, these findings are compared to the previous research, draws conclusions and presents suggestions for the future in this field.

1.1 Background

Early research papers in this field include the work of Lindley & Vercoustre (1998) and Lindley (1999) who used Standard Generalised Markup Language, SGML (a markup language similar to HTML) to synthesise videos based on an online video database, and a tree structured search (Lindley & Vercoustre, 1999). Lindley (2001) also developed an association engine for creating interactive videos.

Further early work was described in a technical report by Guil & Zapata (1998) who outlined issues of real time VVP such as scene rendering speed, syncing with the real camera parameters (lens settings, pan, tilt) and movement (3D-space coordinates). Guil et al (ibid) aimed to “develop a fast image processing algorithm to detect the 3-D camera position and the tilt and pan angles” based on a template placed on the camera, and then use other cameras to get tilt and pan from the angular distortion of the template. They mention mechanical decoders and vision techniques as alternatives. (Ibid.). However, electromagnetic, high-precision motion trackers that could be attached to various devices were also available at that time e.g., Polhemus Fastrak (Pimentel & Teixeira, 1993).

Spielmann et al (2018) presents an interesting collaborative production pipeline tool, built with Unity and Katana, which gets camera tracking data, light capture and estimation, and controls light settings in the room via a lighting server and DMX controllers. (A DMX or Digital Multiplex is the standard to remotely control lighting

fixtures). The tablets provide an AR viewport into the virtual scene and can provide data for syncing the virtual and real world with anchor points. As an example of the technical fidelity needed to create the illusion of presence, James et al (2021) presents an approach for colour-management of LED walls used as background in virtual video production, enabling control of exposure and white-balance across the wall.

While the above technical opportunities and challenges seem fairly well researched during an extensive time period, research about the use of virtual production for teaching seems scarcer. However, Bennett & Kruse (2015) present pedagogical challenges and opportunities to teach visual storytelling via motion capture and visual effects in immersive environments. Recently, research has also been made by Nebeling et al (2021) to ease the use of virtual video production in education with compositing based on pre-sets, in their XRStudio where the production was made in virtual reality to make it more economically feasible without access to a studio environment with LED displays. In contrast, the study in this paper focuses on a real (actual) video studio and how to make it easier to use for education with virtual video production, also with a more affordable approach than LED walls. While adding LED walls provides better immersion for the presenters and easier lighting, many of the benefits of VVP can still be achieved without such expensive LED displays.

1.2 Challenge and research question

The challenge is how to apply the opportunities of VVP that involve syncing of several technical components and layers, designed to be useful within limited course resources. The question is how VVP can be designed and set up in an easy way for teachers and students to use it for presentations in courses?

2. Methods

This study takes a design science research approach (Johannesson & Perjons, 2021) by designing a virtual setup in a studio, with focus on explicating problems (challenges and opportunities). The methods were based on auto-ethnographies of a media producer (the main author) and a teacher in immersive environments (second author), reflecting on our own experiences from concept to production before, during, and after a course about immersive environments running for ten weeks in 2022. The experiences were based on both designing the virtual set, performing technical tests of equipment (cameras, lights, game engine, formats), as well as 3D-space positioning of cameras, and the possible area of recording with both virtual objects rendered in the studio, a background rendered on a large green screen as well as augmented reality (AR) apps developed by students. Instructions for a basic screenplay script with regards to virtual video production were also designed. Virtual production issues were observed while preparing for and then recording three student presentations during three three-hour sessions. The students have signed a consent form to participate with their faces blurred.

3. Findings

3.1 Physical studio considerations for VVP

This study was conducted in a video studio on campus enabling settings for immersion within limitations of what was available and affordable. This section provides details about how the studio was configured and designed, which can be helpful for others who want to create a similar setup and also understand how this study was done.

The floor layout, studio room (39 m2), control room and technical room, was designed by the main author in cooperation with interior architects and a professional audio engineer. In VVP, green screens are today typically replaced by large LED displays that enable actors to be partially surrounded by and see the virtual set directly and also lighting to be applied by the displays themselves. This is a limitation in this study where we did not have access to such displays, but this is also a more affordable variant of VVP for educational purposes. As an example, the main author built a green screen cyclorama (a large concave backdrop positioned at the back of the scene) with a ~€600 budget in 2016. It covers two walls and the floor. It was made of a green needle felt mat on a wooden framework. The needle felt mat was on sale on 3x30-meter rolls, which works both on the walls as well as on the floor where some other type of fabric could make you slip. See Fig. 1.

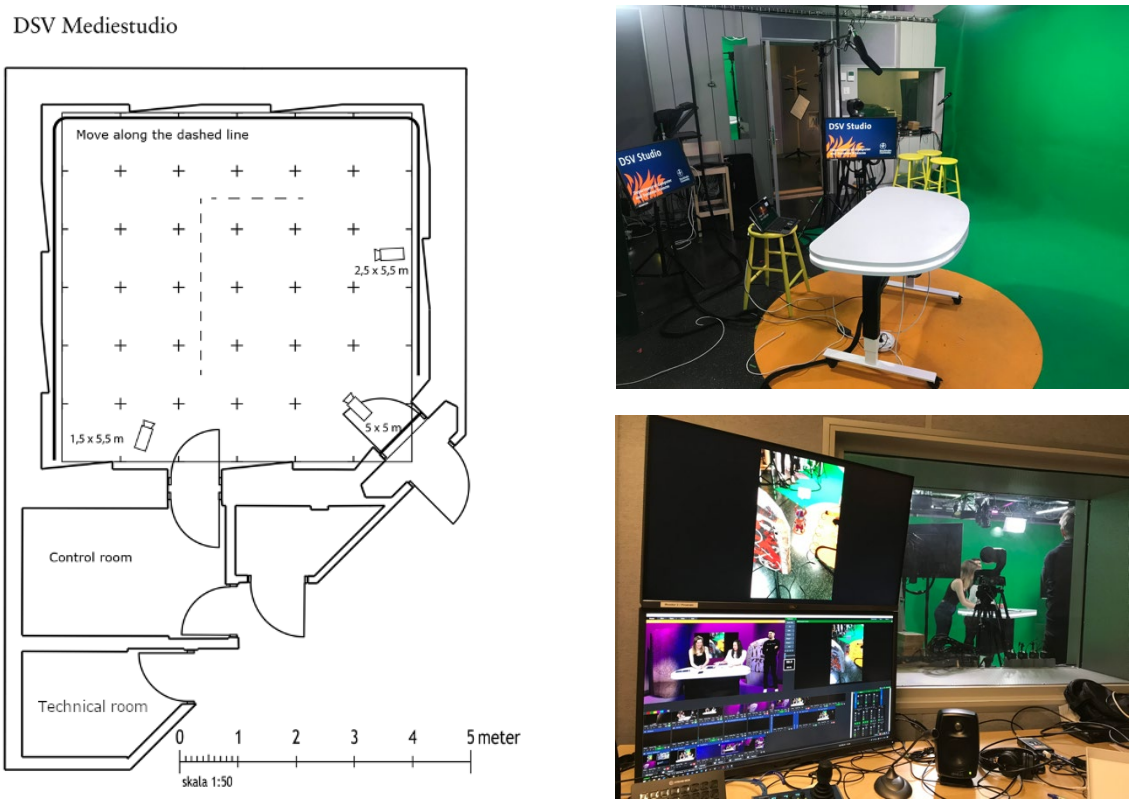

Figure 1: A map of the studio (left), the studio seen towards the control room with reference displays (top right), and the studio seen from the control room (bottom right)

The lighting was standard three-point lighting designed for three-camera shooting with LED-spotlights and fluorescent tubes for lighting the green screen. Recently, 12 RGB-tubes (red, green, blue) for ambient, coloured/white light set up in a grid in the ceiling were added. The lighting can be controlled by a USB-to-DMX-interface hooked up to a laptop with lighting control software. DMX can be controlled by the Unreal Engine game development software, which makes it possible to map the real studio lighting to the virtual world. We have not implemented DMX in the Unreal engine yet, but we did use the RGB-tubes to make the illusions that the virtual walls reflected their light on the students (Fig.2 and Fig.3).

Figure 2: A virtual video production view with background, synced lighting, a virtual presentation screen (here showing live content of an AR app from a tablet) and virtual 3D-objects (in this case, rune stones)

The table had a half-moon shape with an RGB LED strip on the edge (Fig.2). The shape makes the actors open up their bodies facing the camera, thus prohibiting them to be in profile to be more inviting to the audience. The LED strip gives a TV production style. We believe that a studio table with a non-standard appearance fits better in a (virtual) production. Photoshop and free image archives were used to experiment with green screen backdrops in 3-camera setups, to check eye levels of participants and focal length on the camera as it works good enough for fast studio productions. Two camera angles are illustrated in Fig.2 and Fig.3.

We used shotgun microphones (for directed audio recordings with good pickup of voices and little of noise in the room) on boom stands and wireless lavalier (wearable) microphones. We used two Panasonic UE150 PTZ cameras (professional cameras with pan, tilt, zoom that can be remotely controlled with a joystick) and a Panasonic EVA1. We used an HP Z8 workstation with an NVIDIA Quadro RTX 5000 graphics card and BMD Decklink 8k capture card. The cameras were connected to the capture card with SDI-cables (for full dynamic reproduction). We used vMix as video mixer software as it was already configured in the studio but Open Broadcaster Software (OBS) could also have been used. The idea behind using a Windows machine with software instead of using a studio-in-a-box solution like Tricaster is that we wanted to be able to experiment with all sorts of software for production in different settings.

In the studio there were three big monitors on stands showing the recording video (two of the visible in Fig.2). These could be placed so that the actors could see themselves when they interacted with virtual objects on the green screen, for example pointing at a virtual PowerPoint presentation. The monitors could also be used for showing the desktop of the studio workstation to mirror the controls of the control room, enabling an actor or teacher to control everything from within the studio room. Furthermore, the camera joystick and the video mixer control panel could be used in the studio room as well.

Figure 3: A close-up of the scene from a different camera, more clearly showing highlights in the hair and clothes that is synced with the virtual light on the runestone, to create an integrated and more immersive experience

3.2 Implementing Unreal virtual production in the studio

Our Panasonic UE150 cameras come with built in camera tracking. They can broadcast the pan, zoom, tilt and lens data to third party software using the Free-D protocol but cannot track their position in the room. Thus, we started by measuring the studio floor placing out the cameras at exact coordinates in the x, y and z axes. We installed Unreal at the studio workstation. In Unreal, we created a simple virtual studio in the same scale as the studio and placed virtual cameras at the same positions as in the real-world studio.

We used the Disrupt AR plugin in Unreal to read the Free-D tracking data from the cameras and the Live Link plugin to map the tracking data to the virtual cameras. This allowed real-world cameras to direct the pan, tilt, zoom and focus of the virtual cameras. The third camera (the Panasonic EVA1) did not have a tracker and was treated as a static long shot in both worlds.

The images from the virtual cameras were sent to the video mixer (vMix) on the same computer to use as green screen backgrounds. This created the illusion of mixed reality. To feed the video from Unreal to vMix we used the Network Device Interface (NDI) plugin in Unreal. We also used NDI to show the PowerPoint within the Unreal virtual studio. All these settings could be found in several tutorials online.

In vMix you can delay video and audio streams and thus sync all media exactly. The problem with NDI was that there was unpredictable lag. We guess it has to do with its extensible use of the GPU when compressing data via NDI (packing/unpacking) and processing the network data to display data. A generator lock (genlock) should have been used to really sync all audio and video sources.

3.3 Preproduction instructions to students

The students first made a 20 minutes visit in the studio per group to get an idea of possibilities and limitations of the studio. They also got written instructions of what to think about, in terms of prerequisites and a synopsis.

The studio prerequisites which the students were informed about were: *1) A large green screen cover the top and right walls in Figure 1; 2) The three studio cameras cannot be moved while recording as their position in the room cannot be tracked and have to be synced manually with the virtual studio in Unreal; two cameras have remote control of pan, tilt, zoom; 3) Shoot towards the green screen wall closest to the control room* (to ease the setup between groups); *4) 3D-objects in Unreal will not be rendered correctly in depth, which means you cannot go behind as this will still look as you are in front of the 3D-objects; 5) Lighting is possible with colour LED-panels and tubes* (which was also prepared beforehand)*; 6) Three reference displays are available that can be repositioned so you see what you are doing in relation to the green screen; 7) A basic predefined virtual studio environment is used, but your own 3D-objects made with photogrammetry will be added a day before the recording day; 8) AR tablets are connected via a USB-C cable to HDMI; and 9)) The light setup and camera focus are fixed which means you must only move along the dashed line in Figure 1.*

The students also got instructions of writing a basic synopsis to think about: *1) Do you want to have a table or not in the scene, and approximately where in the room?; 2) where do you want to position your AR objects with the tablet?; 3) How do you want to cut between camera sources, and approximately when while recording? Or do you want to edit and cut in post-production? Sources can be three studio cameras, the AR-tablet app and another NDI source (e.g., a Powerpoint).* The synopsis details about tables and positions were helpful to plan the recording session and know where to position cameras. The students also got a link about virtual production in Unreal (https://www.unrealengine.com/en-US/virtual-production) if they wanted to learn more. The students' 3D-objects were based on their own photogrammetry (3D-scanning) of real rune stones from the Swedish History Museum. For some unclear reason, importing high resolution versions of the objects into the scene resulted in distorted models, whereas a low polygon version worked fine (as seen in Fig.2 and Fig.3). Due to limited time this issue was not resolved before the recording session.

Both the studio visits and the instructions were crucial as the students had not worked with virtual video production before. As can be seen from the above detailed description, the studio is a complicated technical environment allowing for experiments but also failures if you do not reflect on how to use it. They got two hours for recording sessions in the studio, one per group of approximately five students. This limited time also called for preparations so videos could be recorded for all groups of students, by the course manager of what content could be included, but also for the media producer to make pre-sets and syncing ready before the recording sessions.

3.4 Production direction of students

When the students arrived on the recording day, they were asked to explain their desired outcomes and their thoughts on how this could be achieved. We helped them to adapt their ideas to the studio setting and gave them directions on how to act into the camera. We also discussed the basic dramatic structure of their

presentation. We made sure that they had a beginning, middle and an end. They got some directions on which camera to look into and that they had to use more energy in their acting. These were media students so they already had some basic training on how to act in front of a camera.

We rehearsed a couple of times. Then we shot the presentation in one take. We recorded all cameras and the live cut version in separate video clips. We transferred all media to the students' own media space. The students were free to use the live cut or to edit their own version from all the media clips. We noticed a need to move the cameras while recording but as everything needed to be in sync, we did not do that.

Some special considerations in the studio regarding presenting augmented reality (AR) apps that the students had made in the course they attended was that: 1) Placing AR objects on walls with green screens required us to cover part of the right wall with a curtain, since AR requires a varied surface for tracking to work properly; 2) Scene tracking is a 3D-scanning technique for positioning objects in the room relative to an anchor and also enables multi-user AR by sharing anchors via the cloud. However, scene tracking requires pre-scanning of the room with the camera where the room setup cannot change too much in-between, and also requires a fairly large open space to make it work.

4. Discussion

To answer the research question, it is useful to make comparisons of our study with the related research. The early work by Lindley & Vercoustre (1998, 1999) resembles some of the early unpublished work made by the main author of this paper, unknowingly of each other at the time. Challenges found in related research were about rendering speed, synchronisation of virtual and real cameras, lighting, and colour management as well as course specific challenges. Some opportunities were co-location/remote teaching, collaborative production, compositing based on presets and using AR to enable sensor data for scene management.

While many of these challenges and opportunities found in the earlier studies remain today, the latest technologies enable new possibilities for teachers and students for more immersive learning experiences. This is further enhanced by free software (e.g. Unreal and OBS) that works with both consumer level hardware as well as in professional studios. However, how to involve teachers and students in an efficient way is not trivial, especially if they have little time, experience of or interest in VVP in itself. In this study, both the involved students and teachers had a focus on immersive environments, so the need for an easy production pipeline can be assumed to be even greater in other types of courses.

4.1 Challenges and opportunities with VVP in education

As found in the related research, VVP has been around as a concept at least since 1998, long before large LED displays existed. While large LED displays are the standard in virtual movie productions today, green screens and reference displays can be used as an affordable option for VVP in education. Large green screens can be made with a low budget. Unreal with plugins is a feasible way to create educational VVP content, also with a low budget except for what is available in a typical video studio. Both approaches allow that the studio model is transferred to different 3D worlds to change location without the need to change the rig of the studio in between educational activities and courses.

A central part of the technical setup is to build a virtual studio environment in Unreal with the same scale as the actual (physical) video studio. One challenge with this was that the virtual and real cameras had different scaling and it was difficult to know what settings to change. While the technical considerations of the studio environment and implementation in Unreal is complex and requires technical expertise to set up, the VVP recording sessions went smoothly and without any severe issues that could not be resolved easily within two hours for each group of students. Outlining prerequisites and providing a visit for students before they planned their presentations with a synopsis helped all stakeholders involved (media producer, teacher, students). This shows the potential for this approach, but the limitation is today the need for involving a media producer that can handle the technical setup (lighting, positioning, audio and more).

4.2 Comparing with VVP research for teaching and learning

Going forward we can learn from the requirements that Nebeling et al (2021) propose for production: 1) “High-quality video without a production team.”; 2) “Automating the production process”; and 3) ““No-technology”

solution for instructors". In this study the first requirement was met with video quality but required an experienced media producer to be present. The second requirement was not fulfilled, as the media producer had to manually set up the technical environment. The third requirement was fulfilled. Nibeling et al (ibid.) also propose instructional requirements, but those focus on VR and not studio production as we do in this study.

Nebeling et al (2021) present a walkthrough of XRStudio with similarities and differences to our approach. The main difference is that they did all production in the virtual XRStudio while we used an actual video studio, but they also provided tools for 2D and 3D sketching and manipulation. There were also several similarities: 1) presenting a default scene with pre-calibrated cameras, which the media producer had prepared in the studio; 2) they had pre-sets for live production with different sources (cameras, slides and more), which we had in the control room; 3) they had mixed reality capture, that we achieved with both studio cameras and the green screen with 3D objects, as well as with the AR apps developed by the students; 4) record and replay, which is naturally possible in a video studio; and 5) they provided multiple output modalities for live or recorded streams, that we also have in the studio, but we only used it for recordings in this study. Also, as Nebeling et al (2021) points out, there are challenges in relying on instructors only to produce videos; e.g. using transitions without thinking about the audience of students is a good example. In this regard, education of using either a VVP studio or a virtual XRStudio is required or involving a professional media producer to some extent.

4.3 A proposed setup for teachers and students

To be useful for students and teachers the studio environment needs to be preconfigured with pre-sets, selected via an easy-to-use interface. This can be achieved with physical, programmable buttons or with similar digital buttons in an app. The pre-sets include light settings, green screen background and 3D-objects and virtual cameras synced with coordinates in the physical studio, and virtual screen to display presentation content. With these pre-sets, students and teachers could simply use the remote-control joystick for camera pan, tilt, zoom need with some instruction. OBS studio should be used instead of vMix so teachers and students can practice with the applications also when not having access to the studio, along with Unreal as both are free software.

By using pre-sets for each course and reducing the complexity to one joystick control and not trying to cut between cameras live, it should be possible to let students and teachers to use virtual video production without much intervention by a media producer in recording sessions. If the joystick is positioned in the studio instead of the control room, it can also simplify the situation further. It may be possible to avoid using the control room altogether, in line with the "no technology" approach. However, not cutting live means that there may be need to make some editing after the recording session, which requires some extra time and basic skills in video editing software. Thus, it may be a better approach to have one person to cut between cameras live, and one person that handles the joystick to control pan, tilt and zoom.

5. Conclusion and future work

The research question was: How can VVP be designed and set up in an easy way for teachers and students to use it for presentations in courses? To answer the research question, we have described our own experiences from both designing and preparing a virtual video production set, and observations while students produced short presentations in a video studio with virtual video production. Based on this we have discussed how VVP can be designed and set up for teachers and students with suggested instructions of prerequisites, questions for writing a synopsis, and what direction was needed during the recording session.

5.1 Future work

In our future work we aim to conduct a study where other teachers and students are involved in the entire design process to learn more about how different courses can utilise the potential of virtual video production for teaching and learning. When implementing a new technology an aim is to not disturb the existing workflow. We would like to create some kind of template or application that can compose the video streams and feed them into our video mixer. When the app starts it should just work. If you want to change the environment or other features there should be a graphical interface for this. We would like the cameras to report their position in the room so that we do not have to measure manually. This could be fixed by implementing a tracking system like HTC Vive or using their new HTC Vive Mars System. We must also deal with the lag and sync problems. This could be fixed by running the Unreal engine on a separate computer and also sync the cameras with genlock.

We have not explored the use of this technology fully in this first explorative attempt. It could be great in subject areas like history to let the teacher be a guide on an ancient site, or in case-based learning where the teachers can act in different environments creating more immersive experiences or in complex technical environments where you can show how it works. Further, it could be used just to create instructional videos that look nice.

With the three cameras positioned in the studio and within the virtual world it is easy to move the whole studio around to different locations without having to do any rigging in the studio. Thus, it could be really time efficient. One possibility would be to try and automate some of the setup and provide AR-based support for what to do (and how) in the studio. The media producer may then be less of a technical support person, and can focus more on direction of teachers and students in acting in front of a camera.

References

Bennett, G. & Kruse, J. 2015. Teaching visual storytelling for virtual production pipelines incorporating motion capture and visual effects. SIGGRAPH Asia 2015 Symposium on Education. Kobe, Japan: Association for Computing Machinery.

Guil, N. & Zapata, E. L. 1998. Real-Time Virtual Video Production. Malaga, Spain: University of Malaga.

Harwood, T. G. & Grussi, B. 2021. Pioneers in Machinima: The Grassroots of Virtual Production, Vernon Press.

James, O., Achard, R., Bird, J. & Cooper, S. 2021. Colour-Managed LED Walls for Virtual Production. ACM SIGGRAPH 2021 Talks. Virtual Event, USA: Association for Computing Machinery.

Johannesson, P. & Perjons, E. 2021. An Introduction to Design Science, Springer, Cham.

Lindley, C. A. & Vercoustre, A. M. 1998. Intelligent Video Synthesis Using Virtual Video Prescriptions. International Conference on Computational Intelligence and Multimedia Applications. Gippsland, Australia: River Edge.

Lindley, C. A. Generic film forms for dynamic virtual video synthesis. Proceedings IEEE International Conference on Multimedia Computing and Systems, 7-11 June 1999 1999. 97-101 vol.2.

Lindley, C. A. & Vercoustre, A.-M. Generic Viewer Interaction Semantics for Dynamic Virtual Video Synthesis. In: Huijsmans, D. P. & Smeulders, A. W. M., eds. Visual Information and Information Systems, 1999// 1999 Berlin, Heidelberg. Springer Berlin Heidelberg, 83-90.

Lindley, C. A. 2001. A Video Annotation Methodology for Interactive Video Sequence Generation. In: Earnshaw, R. & Vince, J. (eds.) Digital Content Creation. London: Springer London.

Nebeling, M., Rajaram, S., Wu, L., Cheng, Y. & Herskovitz, J. 2021. XRStudio: A Virtual Production and Live Streaming System for Immersive Instructional Experiences. Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems. Yokohama, Japan: Association for Computing Machinery.

Pimentel, K. & Teixeira, K. 1993. Virtual Reality: through the new looking glass, USA, Windcrest Books.

Spielmann, S., Helzle, V., Schuster, A., Trottnow, J., Götz, K. & Rohr, P. 2018. VPET: virtual production editing tools. ACM SIGGRAPH 2018 Emerging Technologies. Vancouver, British Columbia, Canada: Association for Computing Machinery.

Machine Assessment of Student Discussion-Board Formal-Style Debates

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Abstract: This paper explores machine identification of argumentative moves in asynchronous online student debates. Student debate is a technique for engaging with topics which have no clear answer. Online debates differ from less-structured discussion-board class discussions in that students are restricted to formal debating moves such as advancing a new argument, providing evidence, or rebutting an argument. They are also assigned to debate a particular side. This research explores whether the different argumentative skills in student debate can be distinguished from each other by reading the texts of the students' discussion. The data for this research are the postings from 20 week-long student debates, an assignment in an educational technology class. Utilizing exclusively the text the students wrote, machine classifiers were trained to recognize the argumentative role of a message. If machines can detect an average difference between these debate moves from the text of the debate, and if they can detect the side of the debate, then the students are likely exercising different argumentative skills. The experiment shows it is possible to identify the skills which make debating different than free-form discussion with accuracy significantly better than chance.

Keywords: argumentation-based learning, computer-supported collaborative learning, computer-supported discussion board, class debate

1. Introduction

This paper applies machine classifier techniques to asynchronous online debate assignments, with the aim of discovering whether debate-specific behaviours could be detected. Discussion-based assignments are suitable for ill-structured or complex topics, where students should employ critical thinking and there may not be clearly correct answers. Imposing debate structure on the student discussion, compared with less structured discussion, promotes critical thinking and argumentation skills, and increases the depth and engagement with the topic.

The debates studied here were administered as week-long online exercises (Jeong, 2006). Students posted their contributions to an online message board. Students were required to post arguments, rebuttals, and other argumentative moves. The broad research question underlying this research is: to evaluate the result. Is it possible to monitor whether students are indeed exercising different argumentative skills, as the assignment requires? If it isn't possible to discern any difference between the students' explanations and rebuttals, for example, that would call the purpose of the exercise into question. If a machine can discern the differences with accuracy better than chance, it could be useful as an aid for monitoring or assessing the online debates.

The research questions of this paper, therefore, are keyed to two ways in which debate assignments differ from free-form discussion:

- Can machine classifiers discern the different debate argumentative moves in the students' texts, with accuracy significantly better than chance.
- Can machine classifiers discern the side of a debate from the students' texts, with accuracy significantly better than chance.

A broader research question guiding these experiments is:

- Do machine classifiers help identify the textual characteristics of a good debate post.

The broader research question relates to understanding and assessing the quality of the text. The machine classifier models could help understand, for example, what constitutes a better argument post versus a better rebuttal post. Potentially they could inform instruction in writing better posts or could provide formative assessment to students. In service of this goal, these experiments are restricted to utilizing the texts of the

posts themselves, eschewing other features which might improve classification accuracy. Discovering textual clues to the quality of a post guided the classifier design but is not answered in this research.

In this paper we describe the rationale for argumentation-based collaborative classroom assignments. We illustrate the debate data used in the experiment. We describe training and testing two different machine classifier models and evaluate the results. We discuss how these statistically significant results validate the salient characteristics of online asynchronous argumentation exercise. Building on this work for the future, we show how statistically significant classifiers could be put to future use assisting an instructor. We discuss how to improve the classifier accuracy. We also discuss how a similar experimental setup could be used to measure the engagement potential of a student's argument, judging whether a student's debate argument is likely to attract responses from other students.

2. Online asynchronous debates

2.1 Collaborative debating assignments

The educational intervention that is the focus of this study falls under the rubric of Collaborative Argumentation-Based Learning (CABLE) generally, and Argumentation-Based Computer-Supported Collaborative Learning (ABCSCL) for computer-supported versions (Noroozi et al., 2012). Collaborative argumentation involves students working together, as contrasted with, e.g., writing argumentative essays by themselves. Using collaborative argumentation as a pedagogical tool is an important trend "whereby learners gain a comprehensive understanding of a problem through the process of trying to convince each other" (Noroozi, 2020). A main pedagogical purpose is to help students engage with ill-structured or complex domains, where problems may not have clear-cut answers.

A purpose of applying debate as a classroom intervention is that argumentation produces constructive interaction (Andriessen, 2006; Baker, 1999). Unlike formal debate competitions, collaborative argumentation is not about winning a debate. Neither is it about changing minds, though it is possible to chart students' evolving conceptions and map argumentative structure (Baker, 2009). Group collaborative debates are knowledge co-construction. The students argue to learn (Andriessen, 2006), each student adding a bit to the overall understanding of the proposition at hand.

Another advantage of debate over free-form discussions is that social processes interfere less with argumentation processes. In unstructured discussion people can be reluctant to counter each other directly, due to issues of politeness, losing face, or fear of starting a fight (Andriessen, 2006).

Knowledge construction dialogues can be described in multiple dimensions, e.g. epistemic, social, participation, and argumentation (Weinberger and Fischer, 2006). The argumentation structure of the discussion is the collection of claims, warrants, refutations, etc. which construct knowledge. The social dimension is the structure and modes of people responding to each other, for example asking questions, advancing an idea, agreeing or disagreeing, or building consensus. The participation dimension reflects how frequently and how much each participant is contributing, and whether participation is homogeneous across the group. The epistemic dimension relates to whether contributions are on or off task, how participants connect theories to the task at hand, and other issues.

2.2 Scripts for debating assignment

The debate assignment is guided by a script. Scripts are an instructional support which "provide some instructions for learners regarding how group members should collaborate and complete tasks" (Noroozi, 2020). The instructions for a collaborative debate regulate the structure of the argumentative aspects of the discussion and reduce the complexity of the discussion in the non-argumentation dimensions. All posts should be on task, learners are instructed to post a minimum number of times, and the permissible varieties of interaction are restricted.

If the participants are following the assignment, their posts will be on-task and restricted to certain argumentative moves and participants will consistently argue one side or the other.

2.3 Argumentative roles and sides of participant statements

In the debates studied here the different argumentative roles a statement can fill are: an original proposition, an argument (meaning a statement making a claim), a rebuttal to a previous statement, an explanation of a previous statement, or evidence for a previous statement (Jeong, 2006). Restricting student dialogue moves to a set of argumentation/debating moves is a form of scaffolding which produces better results than simply telling students to discuss the issue (Cho and Jonassen, 2002; Jonassen and Kim, 2010). Furthermore, by assigning students to different sides of the debate, students are encouraged to form strong arguments for ideas they would naturally dislike and thus avoid engaging (Nussbaum and Kardash, 2005).

A representative broad categorization of argumentative roles is: claim, data, warrant, backing, rebuttal, and qualifier (Toulmin, 1958). Common frameworks used by researchers for modelling and for computer processing of student discussion, such as (Weinberger and Fischer, 2006), contain more distinctions.

The categories used in these debates are simpler than the frameworks used by researchers, designed for use by students. Students were required to be self-aware, labelling each of their posts according to its role. The simplified categories in these debates were refined from earlier experiments, using similar discussion topics, until students showed a high level of labelling accuracy (Jeong, 2004; Jeong, 2006).

2.4 Online asynchronous collaborative debate

In the online debates studied here the instructor posted the original proposition to a discussion board. Students posted arguments in favour of or opposed to the proposition. Other students could post responses, where a chain of responses appears as a discussion board thread. Students could respond to any post already on the discussion board, so there was not strict turn-taking as happens in a formal debate or a verbal conversation. The debate took place over the course of a week.

The discussion board provides a useful representational tool for visualizing the structure of an argument. The visual display of the discussion shows the attachments of posts responding to posts, where each post is labelled with a title, the debate side, and argumentative role. Verbal discussions, by contrast, occur in linear time with alternating turns. The structure of argument discussions is not well-matched to linear presentation. Linear presentation hinders broadening and deepening the discussion (Rummel and Spada, 2005). Tools which visualize debate structure and content are believed to help participants stay on track, consider all aspects of the problem, address different branches of the evolving argument selectively, and in other ways argue more effectively (Noroozi, 2020).

+PROP: Reply to this thread to post arguments to SUPPORT the claim "The Country NED should develop a national distance education program".

> **+ARG1:** The following facts appear to be barriers to an advanced DE program in NED: 1. no mention of computer ownership but only 65% have telephones, not a good sign 2. very few people are educated or are getting educated However, **there is a large immigrant population that is interested in learning the culture and history. Making such course available should smooth assimilation into the culture** for the 1% of new NEDites that arrive each year. (Student 1)
>
> > **-BUT: Language is already a barrier for these immigrants** as most of them speak only a little NEDESE. Assuming instruction was provided in a universal language common to these immigrants, would they be able to handle the complexities of undertaking distance education, on top of taking instruction that might not comfortably be in their native language? (Student 2)
> >
> > **-BUT:** Studies show that most persons (60%) who are interested in distance education have either attended some college or at least have an AA degree. Therefore, **although the immigrants may want to learn the culture and history, they may not be well suited for learning at a distance**. (Student 3)

Figure 1: Extract from debate, showing proposition, argument, and two rebuttals. Emphasis added

3. Debate data

Figure 1 illustrates an extract from the debate transcripts used in this study. The debates were administered in a graduate educational technology class at Florida State University (Jeong, 2006). Each debate starts with two proposition posts from the instructor: one in support and another in opposition of the main topic. There is one record for each student post thereafter. There are debate logs from five class cohorts. Each cohort participated in four debates, totalling 20 debates with 2,068 posts in the entire dataset. Students typically posted about 6 times in each debate.

Each debate posting contains the side of the debate that the student represented, a message type label, a subject title, the text of the post, an anonymized student ID, a timestamp, and information to identify which post it was responding to. The two sides are "+" and "-". The message types are PROP, ARG, BUT, EXPL, EVID, AMEND, or RETRACT. The PROP posts are only posted by the instructor of the course. The next four message types are argumentative roles: state an argument (ARG), challenge a previous post (BUT), provide an explanation to another student's post from the same side (EXPL), or provide evidence for a previous post in the debate (EVID). AMEND and RETRACT student postings are not included in this study.

The ARG posts are numbered sequentially. The first argument on each side. of the debate is ARG1. Figure 1 shows a proposition, an argument in favour of the proposition from one student, and two rebuttals to that argument from two others

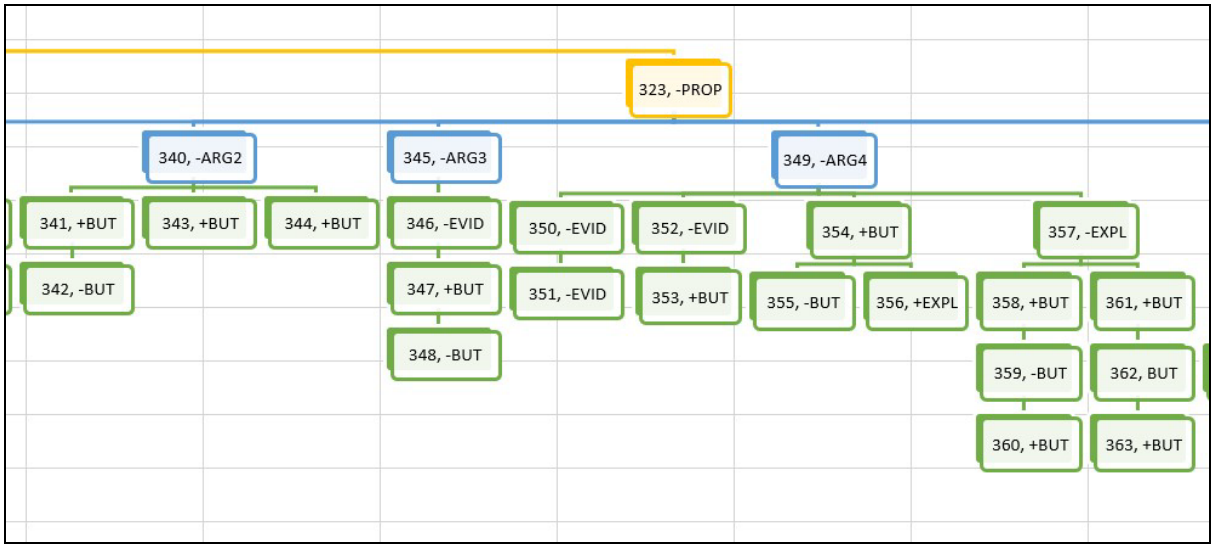

Figure 2: Tree structure of debate postings, showing three arguments from the opposing side with responses

Figure 2 shows the structure of postings from part of a debate. Notice that some arguments, e.g. ARG4, attract chains of back-and forth with rebuttals, evidence, and explanations. Some arguments attract less engaged discussion, and 17% of argument moves attracted no response.

Table 1 shows the counts and proportions of the different argumentative roles of the debate postings. The prompt instructed the students that each post would contain only one argumentative role. Posts for each side were nearly evenly split: 1,037 (50.3%) for the opposing side of a debate, and 1,023 posts for the supporting side.

Table 1: Proportions of different argumentative roles

Role	Number	% of Total
ARG argument	393	19
BUT rebuttal	961	47
EXPL explanation	296	14
EVID evidence	370	18
PROP proposition	40	2

4. Machine classifier experiments

4.1 Classifier models

We trained classifiers to label a) the side of the debate a post represented, and b) the argumentative role of the post. Each classifier is a support vector machine (SVM) with a radial basis kernel. Class weighting was applied during training to compensate for unbalanced frequency of categories. Weighting during training reduces the tendency of the trained classifier to err toward over-predicting the most frequent categories.

There are five categories for the argumentative role of a post. The Scikit-Learn SVM-SVC algorithm implements multi-category classifiers by training binary classifiers for every one-on-one pair of categories. Then it combines the results. The side of the debate is a simple two-category model.

Each model was presented with tokenized text of the student's post, prepared by the NLTK text tokenizer. The vocabulary was restricted to the 1,500 most frequent tokens, out of over 9,000 unique tokens. We applied a random 60%/40% training/evaluating split and an 80%/20% split. Models were programmed in Python using Scikit-Learn, Keras, and NLTK libraries.

Table 2: Evaluation of classifiers

Target	Train/Test Split	Kappa	Accuracy
Role	60/40	0.25	0.48
Role	80/20	0.29	0.50
Side	60/40	0.26	0.63
Side	80/20	0.26	0.63

4.2 Evaluation

Table 2 shows the results of applying the trained classifiers to the evaluation data. The trained classifiers were evaluated using the Kappa statistic (Di Eugenio and Glass, 2004). Kappa is commonly used for comparing two sets of categorial ratings. We compared the argumentative role and the side of the debate, as predicted by the classifier, against ground truth labels from the evaluation data. Kappa = 0 means the classifier agreed with the ground truth with the same accuracy as expected by independent random guessing, where guesses are distributed according to frequency of the categories. Kappa = 1 means the classifier was in perfect agreement with the labels in the data. Kappa = 0.25 means the classifier correctly captured 25% of the erroneous cases a random classifier would have missed.

A random classifier that predicted argument roles according to their frequencies in Table 1 would have accuracy about 0.31, this accuracy was improved to 0.50. Random prediction of side would have an accuracy of about 0.50, this accuracy was improved to 0.63. All the experiments performed much better than chance. A chi-square test on the four evaluation cases in Table 2 show all results are significant with $p < 0.01$.

5. Results

The two research questions are answered in the affirmative. The hypothesis that debate-specific behaviours can be recognized in the text of the student debates is borne out.

The result shows unambiguously that within our dataset of 20 different online asynchronous student debates there are differences among the different types of debating argumentation roles. There are also differences in arguing for and against a proposition. The differences can be discerned by a relatively simple machine classifier, using only the text of what the students wrote.

Individual posts are not reliably classified in our experiment. However statistical tests show the improvement over a random classifier is not an accident. Therefore, a classifier applied to a collection of posts should be able to provide information for estimating the frequencies of each category within the aggregate.

6. Discussion

6.1 Validating the computer-based collaborative debate assignment

The main value to this work is to show characteristics of the assignment that are particular to collaborative debating can be detected in the students' work.

The script encourages the student to utilize certain types of argumentative moves. Students are assigned to take sides. Both these activities have been shown in general to be pedagogically beneficial, both differ from free-form discussion. The computer classifiers can find distinctions within the student data based on these activities.

It is reasonable to conclude that student debate behaviour is indeed influenced by the scaffolding script. In the future computer classifiers could be used to help assess and monitor the activity.

6.2 Accuracy of classifiers

Classifier accuracies of about 0.50 (role) and 0.63 (side) mean that categorizing individual posts would not be accurate enough for assessing individual posts. In section 6.3 of this paper, we discuss how accuracy could be improved.

The classifiers based on word tokens constructed in this experiment do not appear to be accurate enough to use for discovering associations between text features and argumentative categories. The broader question behind our experiments, machine detection of text features characteristic of the quality of the posts, therefore, remains unanswered.

7. Future work

7.1 Aggregate machine classifiers as instructor tools

The result suggests that an automated assessment tool based on machine classifiers could assist instructors in monitoring the debates. Recall that debates happen asynchronously over time. Students in these debates logged in and contributed multiple times over the course of a week. The debate structure is not linear. New posts often respond to other posts in the middle of a tree structure. It is difficult for an instructor to keep abreast of the developing debate.

During the week that the debate accretes, automated classifiers applied to the developing collection of posts could provide guidance as to which aspects of the debate might deserve an instructor's attention.

The automated classifier labels would be compared to the participant's own labels, tabulating disagreements. A debate where the classifier applied to the aggregate of all posts differed more often than expected might benefit from attention. In a similar vein, disagreements could be measured according to each type of argumentative move, or according to the side of the debate, to identify possible problems. An instructor reading the debates might concentrate on the student posts that did not agree with the automatic classification, a set which is likely to be enriched with students who are unskilled in the argumentative moves or are not following the spirit of the assignment. Concentrating on the posts correctly classified is more likely to find the exemplary ones.

7.2 Machine identification of engagement

In asynchronous online debates students choose which posts to respond to. An argument which attracts no responses does less to advance the purpose of the assignment than an argument which attracts many responses. Thus, it will be useful to predict the amount of engagement an argument is likely to attract.

Preliminary work by Cooper (2022) has found machine classifiers can predict better than chance whether a post will be followed by any responses, based solely on the text of the post. There are other explanatory factors beyond the text of the post. For example, Cooper (2002) also found that posts later in the debate are less likely to attract responses.

There are several quantitative measures of engagement that could be modelled. Some possibilities are a) how many direct responses a post receives, b) how many different students choose to engage with an argument, and c) the length of the sequence of turns which follows an argument (Cooper, 2022). Argument posts are intended to start a thread of debate, it might be productive to study the engagement potential of argument posts separately from the other debate moves.

The ability to predict engagement could also help discover the textual aspects that produce more engaging posts. Jeong (2005) has shown, for example, that intensifier words (e.g "very," "never," "only") and qualifier words (e.g., "I think," "probably") change the likelihoods of different types of responses.

7.3 Improved classification accuracy

This work utilized only the text of the student posts. For better accuracy more information can be found from utilizing additional information, viz: a) non-text structural features and b) the discussion context of a post.

The non-text features of a post are useful for classification because side and argumentative move are not independent of the structural context. The post attached to an original proposition is most likely an argument and an argument is most often followed by a rebuttal. There are other statistical relationships among the various argumentative moves and sides of an argument (Jeong, 2005). Adding the structural context of a post to the classifier's input data could thus be used to improve classification accuracy.

Examining the text of adjacent turns has also been fruitful in improving classifier performance. For example, a study modelling argumentative dialogue acts in student collaborative discussions utilized a context of several consecutive dialogue turns (Rosé et al., 2008). In a tree-structured discussion, classifying a post would also include as context the text of the predecessor (parent node) of the targeted post and possibly the responses (child nodes) also.

It may also be productive to apply other natural language processing technologies. Experiments with some newer techniques did not improve accuracy compared to the word tokens and SVM utilized in this paper (Cooper, 2022). However BERT (Bidirectional Encoder Representations from Transformers) has quite fruitfully been applied toward machine modelling of student conversations, so there are likely avenues for improvement there (Dowell and Kovanovic, 2022).

8. Conclusions

Online collaborative debating assignments can checked by computer to see whether students are following the debate instructions. This work shows that machine classifiers are able verify that students are engaging in the valuable behaviours which make argumentation-based collaborative learning distinct from free-form discussion.

We trained computer text classifiers to validate a set of computer-based asynchronous collaborative debate classroom exercises. Students posted their debate contributions to an online message board over the course of a week. Debate exercises differ from free-form student discussion by restricting participant contributions to a set of argumentative debate moves, and by assigning participants to a particular side of the debate. We achieved statistically significant accuracy in machine identification of these two characteristics, using only the text of the student posts. This machine result validates, that participants behaved in ways that are salient to the format of a debate exercise.

This result points the way to potentially useful machine aids for instructors in administering and teaching online debate exercises.

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References

Andriessen, J. (2006) "Arguing to Learn", in Sawyer, R.K. (ed.) *Cambridge Handbook of the Learning Sciences*, Cambridge University Press, Chapter 26.

Baker, M. J. (1999) "Argumentation and Constructive Interaction", in Rijlaarsdam, G. and Espéret, E. (series eds.), Coirier, P. and Andriessen, J. (vol. eds.) Studies in Writing: Vol. 5. *Foundations of Argumentative Text Processing*, pp 179–202.

Baker, M. J. (2009) "Intersubjective and Intrasubjective Rationalities in Pedagogical Debates: Realizing What One Thinks", in Schwarz, B., Dreyfus, T. and Hershkowitz, R. (eds.) *Transformation of Knowledge Through Classroom Interaction*, Routledge, Chapter 9.

Cho, K. L. and Jonassen, D. H. (2002) "The Effects of Argumentation Scaffolds on Argumentation and Problem Solving", *Educational Technology Research and Development*, Vol. 50, No. 3, pp 5–22.

Cooper, A. (2022). *Gauging Student Participation in Online Asynchronous Debates*, M.S. Thesis, Dept. of Computer Science, North Carolina Agricultural and Technical State University, pp 34–45.

Di Eugenio, B. and Glass, M. (2004) "The Kappa Statistic: A Second Look", *Computational Linguistics*, Vol. 32, No. 1, pp 95–101.

Dowell, N. and Kovanovic, V. (2022) "Modeling Educational Discourse with Natural Language Processing", in Lang, C., Siemens, G., Wise A. F., Merceron, A. and Gasevic, D. (eds.) *The Handbook of Learning Analytics*, 2nd ed., SOLAR, Chapter 11, pp 105–119.

Jeong, A.C. (2004) "The Combined Effects of Response Time and Message Content on Growth Patterns of Discussion Threads in Computer-Supported Collaborative Argumentation", *Journal of Distance Education* Vol. 19, No. 1, pp 36–53.

Jeong, A.C. (2005) "The Effects of Linguistic Qualifiers and Intensifiers on Group Interaction and Performance in Computer-Supported Collaborative Argumentation", *International Review of Research in Open and Distance Learning*, Vol. 6, No. 3.

Jeong, A.C. (2006) "The Effects of Conversational Language on Group Interaction and Group Performance in Computer-Supported Collaborative Argumentation", *Instructional Science*, Vol. 34, No. 5, pp 367–397.

Jonassen, D. H. and Kim, B. (2010) "Arguing to Learn and Learning to Argue: Design Justifications and Guidelines", *Educational Technology Research and Development*, Vol. 58, No. 4, pp 439–457.

Noroozi, O. (2020) "Argumentation-Based Computer Supported Collaborative Learning (ABCSCL): The Role of Instructional Supports", *European Journal of Open Education and E-learning Studies*, Vol. 5, No. 2, pp 16–32.

Noroozi, O., Weinberger, A., Biemans, H. J., Mulder, M. and Chizari, M. (2012) "Argumentation-Based Computer Supported Collaborative Learning (ABCSCL): A Synthesis of 15 Years of Research", *Educational Research Review*, Vol. 7, No. 2, pp 79–106.

Nussbaum, E. M. and Kardash, C. M. (2005) "The Effects of Goal Instructions and Text on the Generation of Counterarguments During Writing", *Journal of Educational Psychology*, Vol. 97, No. 2, pp 157–169.

Rosé, C., Wang, Y. C., Cui, Y., Arguello, J., Stegmann, K., Weinberger, A. and Fischer, F. (2008) "Analyzing collaborative learning processes automatically: Exploiting the advances of computational linguistics in computer-supported collaborative learning", *International Journal of Computer-Supported Collaborative Learning*, Vol. 3, No. 3, pp 237–271.

Rummel, N. and Spada, H. (2005) "Learning to collaborate: An instructional approach to promoting collaborative problem solving in computer-mediated settings", *The Journal of the Learning Sciences*, Vol. 14, pp. 201–241.

Toulmin, S. (1958) *The Uses of Argument*, Cambridge University Press, Cambridge.

Weinberger, A. and Fischer, F. (2006) "A framework to analyze argumentative knowledge construction in computer-supported collaborative learning", *Computers and Education*, Vol. 46, No. 1, pp 71–95.

Haptic Technology in Digital Music Learning Context: A State-of-the-Art Analysis

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Abstract: Digital media have become increasingly established in learning contexts in recent decades, and it seems impossible to imagine education without them, especially in recent years. Various technological advances can be observed, such as developments in virtual reality and augmented reality. To give learners a realistic impression of the virtual world, as many sensory impressions as possible should be addressed. However, current developments have mainly addressed the visual and auditory modalities, which make up two of the five human senses. Research and developments for the use of the other senses are being made but at this stage they are not yet ready for mass use. Especially the sense of touch based on skin as the largest human sensory organ or tactile and haptic perception seem to be of interest. Particularly in manual or medical areas where motor skills are required, haptic technologies are declared to be supportive and beneficial. One area that has hardly focused on digital learning so far is the music sector. Learning a musical instrument in this context seems to be an interesting field of research, as it not only promotes motor skills, but also cognitive development in both children and adults. To give an update on the technical developments in the field of digital teaching and learning in music, and especially to highlight the use of haptic technologies, we will briefly review the state of the art in this paper. It begins with a brief overview of the basics of digital learning and haptics, as well as previous work in this field. Using the method of a scoping review, the topic of haptic technologies in the field of music education will be researched, analysed, and summarised according to defined criteria to give a condensed overview of it. The selected database and appropriate search strings will be used to achieve the aim of the paper. The results help to shed light on current research gaps and give indications for future developments of haptic technology in the music learning context.

Keywords: haptic, technology, digital learning, music, scoping review

1. Introduction

An increase in the use of digital media like web-based trainings, collaborative platforms, mobile applications and learning videos can be observed in various educational settings, be it in schools, vocational training, or further education. Current studies investigate how digital media can influence and enhance learning (Tamim et al., 2011). Moreover, there has been progress in the development of technologies used in the learning context. Particularly noteworthy are emerging technologies such as virtual reality (VR), augmented reality (AR), or mixed reality (MR), which can be summarised by the term extended reality (XR). VR is used, for example, in medical training (Ruthenbeck & Reynolds, 2015) or in automotive mechatronics training (Kamińska et al., 2021).

Particularly regarding these examples, which involve learning motor skills such as certain motion sequences, pressure or palpation, not only visual and auditory perception is important, but also tactile and haptic perception. In the virtual world, mainly the two senses vision and audition have been focused on so far. To give learners an impression of XR that is as realistic as possible and thus enable a sustainable transfer of learning, addressing as many senses as possible is seen as beneficial (Dörner et al., 2019). There are initial approaches in research and development to address additional senses such as the sense of smell or taste (e.g., Cheok et al., 2018), but these are not yet mature enough to be disseminated.

A further promising area for incorporating tactile and haptic perception with the aim of learning motor skills and support learning with technologies is music. For learning in the field of music, research results from the perspective of music education and music psychology are of particular interest. Previous research on motor skills or haptics has focused on how impaired people can be supported either in music lessons, playing instruments or through music. Exemplary impairment contexts are Braille (Park, 2015), hearing aid implants (Fletcher, 2021) or rehabilitation measures (Cheng et al., 2016).

However, previous studies seem to have investigated less the use of digital media and technologies in the context of music learning. For this reason, the aim of this paper is to provide an overview of the current state of technological developments in the field of digital haptic teaching and learning in music and to identify existing research gaps. To achieve this goal, haptics and its role in technologically induced learning will first be explained before the previous work and the used method of a scoping review will be presented. Finally, a presentation of the results and a summary of the paper with an outlook and limitations. The contribution of this paper consists in answering the following two research questions:

- What haptic technologies are currently used in the context of music learning?
- What are advantages and challenges of using haptic technologies in the context of music?

2. Definition of 'Haptic'

The word 'Haptic' refers to the sense of touch. Everyone is familiar with the sense of touch in real life, but what haptic technology offers is an interaction between users and a device via touching and manipulating objects, that are often presented virtually. By simulating or enriching what humans feel in real life when touching objects, haptic technology allows for a tactile experience while interacting with a digital system. Haptic technology enables various kinds of interactions with computer-generated objects and information.

Distinct levels of interaction can be integrated in systems using haptic technology (Dörr et al., 2022). Some systems work with high level of interaction which means user and system interact mutually, while in some other systems equipped with haptic technology, only middle or low level of interaction between the system and a user is needed, meaning that there is less feedback and manipulation from user and/or system side. Another characteristic of haptic devices is the way that a user is supposed to interact with them, i.e., the type of feedback provided by a specific device. To create a believable illusion of touch via technology, several types of haptic feedback can be implemented in haptic devices. This is because the receptors on the skin of the human body are sensitive to diverse types of haptic cues such as pressure, vibration, temperature, etc. (Sallnäs et al., 2000). Tactile feedback and force feedback are two types of haptic feedback which can often be found implemented in a haptic device. As Burdea (1999) describes, tactile feedback intends to simulate some characteristics such as smoothness, surface contact geometry, and temperature of objects, while force feedback aims at reproducing other attributes such as hardness and weight of the objects. Campos et al. (2011) who studied the effect of haptic feedback in a game-based context explained that when there is an obvious link between the context that users experience and the haptic feedback that they receive, immersion is improved. To keep the immersion at a high level, these haptic feedbacks should be consistent.

Haptic feedback can be provided by a device as the only kind of the feedback, or it can be accompanied by other types of feedback such as visual or auditory feedback. To implement haptic feedback in a system, various kinds of visual environments such as AR, VR, or a display screen can be used. Although, it is not obligatory to provide a visual environment whenever it comes to haptic feedback (Norouzinia et al., 2022).

Taking motor learning process as an example, haptic interactions play a significant role for different age groups and particularly for newborns and kids (Rochat & Senders, 1991). Findings revealed that giving the students the opportunity to explore objects by touching may help them to better conceptualize them and when it comes to objects which are not available in daily life, such as orbits, haptic technology can be helpful by providing learners a haptic experience in a virtual environment. Using haptic technology, learners get the chance to be actively involved in learning and this can make the learning processes more advantageous (Barfield, 2010).

3. Previous work on technology-enhanced music learning

Numerous studies have explored the impact of using technology in learning. Although the use of technology can lead to positive effects on learning outcomes and motivation (Lin & Chen, 2017), Remillard et al. (2021) found out that it is important to first understand teachers' goals, needs, and their current methods before expecting them to use digital instructional resources. This is because their findings reveal that teachers are much more likely to use digital instructional resources when these are in line with their goals.

Considering the field of digital music learning, Camlin and Lisboa (2021) explain that digital learning and online learning is not something new. However, the need to use technology in music learning was increased by the pandemic.

Waddell and Williamon (2019) conducted a study regarding the use of technology in music learning to investigate to what extent music learners can use different technologies and how likely they are to use technology. The study investigated not only learners' behaviour in a music classroom, but also situations in which they want to practice music on their own. Results revealed that musicians prefer smartphones, laptops, and desktop computers more than audio and video recording devices, and playback equipment. Moreover, new technology is considered to have the potential to enhance music learning "through advanced and interactive systems".

In addition to these various devices, different other technologies play an important role in digital music learning, e.g., for musicians. Applying XR in musical contexts by integrating music sound can lead to a particularly enriched as well as highly interactive and controllable experience (Turchet et al., 2021).

Furthermore, there are studies in which haptic devices have been developed to improve music instrument playing. These vary between the instruments focused on (e.g., flute, Zhang et al., 2019), the systems developed (e.g., haptic gloves, Pala & Türker, 2019) and the type of learning (e.g., motor learning, Zhang et al., 2019).

Zhang et al. (2019) for example developed a haptic interface to assist in learning to play the flute, with a clutch mechanism attached directly to the instrument. They emphasize the relevance of multimodality in learning to play instruments and argue in their study that adaptive learning overrides static, traditional learning. They see their system as promising, which focuses on adaptive, interactive, and haptic-supported learning.

4. Methodology

To achieve the goal of this paper to receive a broad overview and to identify research gaps concerning haptic technologies in digital music learning, a scoping review based on Arksey and O'Malley's (2005) methodological framework was conducted. Following the first of five stages of their framework, we started with the identification of research questions. The resulting two research questions are listed in the Introduction and represent the main focus of the paper.

To identify relevant studies as stage two of the Arksey and O'Malley's (2005) framework, the search was carried out by using the database Web of Science being considered as relevant in the field of educational research (Newman & Gough, 2020). For this purpose, the three categories haptic technology, learning and music were formed with representative search terms per category. An iterative process of initial literature reviews was then used to adapt the final search string, which can also be seen in Table 1. This was entered on 2 May 2022 in the selected database Web of Science, which was searched for hits in title, abstract or keywords and exclusively considered studies in English language.

Table 1: Search string and -results

Search String: (haptic* OR tact*) AND (educ* OR learn* OR train* OR teach*) AND (music*) NOT (braille OR medic*)			
Database	**Search field**	**Hits**	**Initial Selection**
Web of Science	Title, Abstract, Key words	156	17

For stage three, the selection of articles matching the research questions, all abstracts of the found articles (n = 156) were first read and analysed based on the inclusion and exclusion criteria (see also Figure 1 for visualisation). The criteria were developed post hoc according to the methodology of scoping studies (Arksey & O'Malley, 2005) after becoming more familiar with the literature. Thus, no restriction was made in publication years as it would have limited the selection too much. In addition, studies that focused on medical aspects or Braille were excluded because the terms in first search trials provided an incorrect focus for this paper. In contrast, papers were included that were aimed at the research project, contained search terms in the above-mentioned categories and were in English language. Thus, of the n = 156 search results, n = 17 abstracts were selected, and then the respective full studies were read, which were assumed to fit the present research questions.

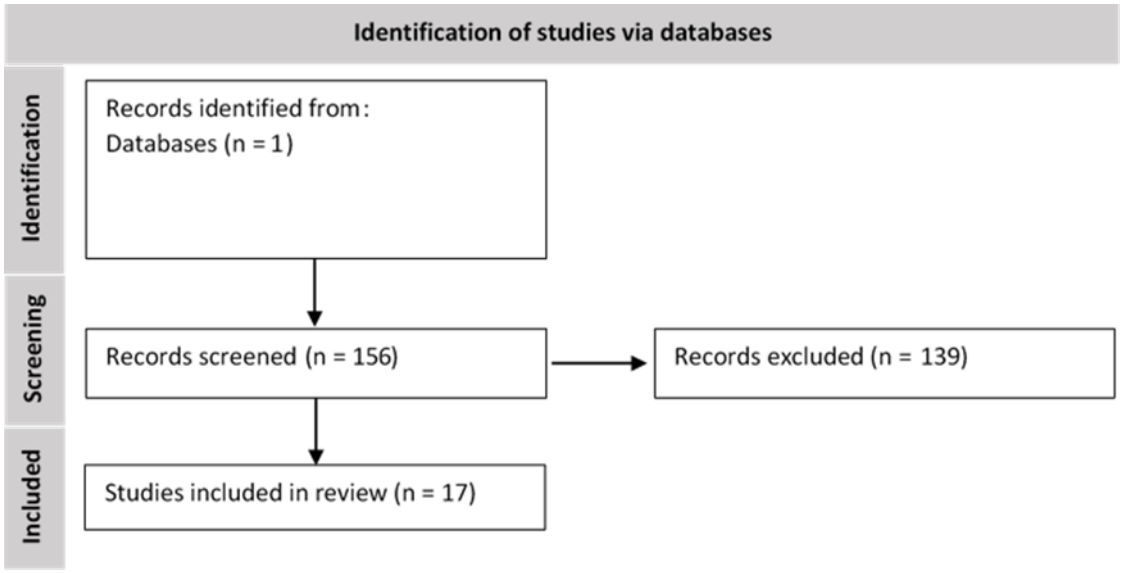

Figure 1: Visualisation of used databases and included records (based on PRISMA Statement, 2020)

According to the described stage four of the scoping method, the selected studies were analysed twice by reviewing, recording, and sorting the material according to important key questions and topics. The data examined from the selected studies were sample, music learning context, haptic experience, and technology. The results of the analysis are broken down in the results chapter, although it should be noted that some studies did not provide all the data just mentioned. In the following chapter, the results are also compiled, summarised, and reported in line with stage five of Arksey and O'Malley's (2005) framework.

5. Results

The information extracted from the 17 selected and analysed studies were sorted into four categories: sample, music learning context, haptic experience, and technology. Table 2 shows detailed information on the studies.

Table 2: Summarised results

Authors (Year)	Sample	Music (Learning) context	Haptic Experience	Technology
Ho et al. (2022)	Kindergarten and school children	Music culture in Taiwan	(Pop-up) book with tangible elements of different texture	Application for AR with Tablet
Senecal et al. (2020)	Adults: regular and non-dancers	Salsa dance skills	Haptic feedback through controller	VR with Headset, Controller, Markers
Walzer (2021)	Educators for music production	Ideas for learning environments for sonic practitioners	Playing musical instruments	Digital Audio workstation
Bremmer et al. (2021)	Music teachers for special education	Multimodal approaches of music teachers for a specific method	Different materials varying in shape, texture, usability, ...	/
Wallmark & Allen (2020)	Children from preschool and day-care facilities; adults: musician and non-musician	Patterns of crossmodal mappings of timbre, age, sensory modality	Smooth and rough sandpaper	/
Fontana et al. (2020)	Community and developers for digital/virtual instruments	Development of digital/virtual instruments in Unity3D	Force and tactile feedback through robotic arm	Desktop, Phantom Robotic Arm, Keyboard
Ludovico et al. (2017)	Children and adults of all ages	Experiential learning by a sound installation	Touching a metal plate	Laptop, audio power amplifier
Nanayakkara et al. (2013)	Hearing-impaired people	Enhancing musical experience for deaf	Haptic chair	Vibrating haptic chair, computer display

Authors (Year)	Sample	Music (Learning) context	Haptic Experience	Technology
Gunther & O'Modhrain (2003)	/	Facilitating the composition and perception of musically structured patterns of vibration on the body	Transducers to transfer vibrotactile response	A vibrotactile stimulator comprised of 13 transducers worn against the body
Nunes-Silva et al. (2021)	/	Focusing on interaction between musician and instrument & role of sensory feedback on music performance	Interaction of fingers and instruments	/
Huovinen & Rautanen (2020)	Primary school students	Creative music-making in groups	Traditional musical instruments	iPad tablet computers
Debevc et al. (2020)	School students	Supporting & motivating learners and teachers to achieve mastery in solfeggio	Rhythm tapping on a mobile display	Mobile application with AR
Cheng et al. (2016)	Professional pianists: healthy or suffering from Musician's Dystonia	Reducing Musician's Dystonia during piano playing	Tactile variation through wearing latex gloves	Metronomic click sound of a computer, EEG
Zappi et al. (2012)	Electronic musician	Using a robotic arm to control and create music	Force feedback by touching a robotic arm	Generic controller, robotic arm, display wall
Luciani et al. (2009)	Adults: musicians and non-professional musicians	Meaning of ergotic audio-haptic situations for performing musical tasks	Friction sensation variation of a virtual bowed string	Model of a virtual bowed string, ERGOS haptic devices, audio-haptic simulator
Rose (2008)	/	Overview of Australian music history	/	/
Lage et al. (2007)	Musicians	Using visual, tactile and auditory information for intonation control in the double bass	Tactile feedback variation via foam cushions on the instrument	Pick-up attached to double basses, mixer to amplify signals, computer

In 14 of 17 studies the sample was named. In five studies, children were named as the sample, which can be summarised in the range from kindergarten to approximately primary school. In two of these studies, adults were also mentioned. In five other studies, the sample could be summarised as musicians, and in two additional studies the sample consisted of music teachers or educators. In two studies, no specific classification could be made, but impaired people and developers were represented individually.

All the studies dealt with various forms and fields of music learning, which are summarised here under the heading music learning context. There were eight studies that can be grouped under music performance. Five studies dealt with music education and three with experiencing music. One of the studies was assigned to the topic effects of musical training.

Haptic manipulation was mentioned in 16 studies. In nine of these, no technologies, but various other materials and musical instruments were used to evoke tactile perception. Seven of the studies used different technologies for haptic manipulation.

Of the 17 studies, 13 reported using technology. They always referred to hardware, either used individually, combined, or used as a supplement. Three studies reported XR, two as an AR application and the other as a VR learning scenario. One of the studies with XR also used vibrating technology, which was also used in two other studies. Another study dealt with an AR-supported software for mobile devices that required learners to tap rhythms, being a form of tactile interaction. In six studies, additional music equipment was explicitly used, e.g.,

in the form of a metronome or a keyboard, or hardware which was attached to a real instrument. In two of the studies, only hardware was mentioned that had no direct connection to music, vibrating technology or XR.

6. Discussion and conclusion

The present scoping review tried to compile and analyse prior research on the use of haptic technologies in the context of music learning. It found that haptic sensation plays an important role in investigations on musical experiences and music performance and that haptic manipulation is realized in various ways, including innovative digital devices and simple tools like foam cushions. However, the current review indicates that experimental research on the impact of haptic feedback in music education is still scarce. Nevertheless, several included studies emphasize the potential of haptic technology for the field of music learning for different targets groups (e.g., Nanayakkara et al., 2013)

Regarding the first research question of this review, haptic technologies used in the context of music learning were investigated concerning the included papers. Results showed that haptic manipulation was realized by means of technology in only about 44% of the papers analysed for the present review. While two papers used technology-based vibrating full-body stimulators, the most prevalent forms of haptic technologies concerned the hands (e.g., controllers, robotic arms, and experimental musical instrument). Moreover, a few of the technology-enhanced and non-technological haptic musical interfaces showed to be combined with innovative digital applications, e.g., in AR or VR (Ho et al., 2022; Senecal et al., 2020). A wider dissemination of haptic technologies in the field of music would facilitate the interconnection to such upcoming XR-technologies that showed to be advantageous, especially for music (e.g., Turchet et al., 2021). For example, wearable devices as haptic gloves could be used to create a smooth and effective (learning) experience in a XR (see Dangxiao et al., 2019 for an overview of haptic displays). They might be especially useful for learning and playing musical instruments since most instruments need interaction with one or both hands and provide a kind of tactile feedback.

Concerning the second research question on advantages and challenges of using haptic technologies in the context of music, we found that while only few of the papers of the current scoping review concentrated on the effects of haptic feedback for musical learning processes or learning gains, some of them still highlighted the (future) potential of haptic stimulation in music education. For example, Nanayakkara et al. (2013) stated that their prototype namely the haptic chair can serve as a help for deaf people to learn playing an instrument or singing. Moreover, even though Luciani et al. (2009) did not explicitly address learning goals in their study on the role of ergotic sounds for music creation with (virtual) bowed string instruments, they found that using haptic feedback to create an adapted and well-tuned ergotic sound situation can improve instrumental learning. To sum up, since the benefit of haptic feedback for the music domain seems to be undoubted, a further development and a broader use of technology-based haptic feedback holds a lot of potential. Compared to non-technological haptic manipulation, technology-based haptics can be applied more implicitly and less intrusively and integrated nearly invisibly into a musical set-up. Thus, technology can contribute to a more realistic, multimodal, and effective musical (learning) experience with less distraction for musicians and a more fine-graded, individually tuned, and adaptive haptic feedback. Still, haptic devices can be expensive and may need technical expertise to apply, which may make them not accessible for all users yet.

The present review faces some limitations. To ensure a high standard of included studies and to primarily focus on education, we used the database Web of Science. Nevertheless, we thus neglected studies of different or rather distant fields that could not be found via the mentioned source (e.g., Papetti & Saitis, 2018). This review also faces a publication bias as it does not include non-published studies. However, first trials to expand the search in other databases like Google Scholar or in other fields like Human Computer Interaction support the conclusion that haptic feedback in music learning is an emerging topic, and results suggest that haptic feedback can be beneficial for learning (e.g., Tom et al., 2020). A further limitation concerns the definition of a musical learning context. For our review, we also included studies on dancing (Senecal et al., 2020) and sound production (Ludovico et al., 2017) since we considered these subjects to be inextricably linked with music. Nevertheless, it should be mentioned that the typical haptic feedback given while playing an instrument might not be easily comparable to these previously named musical contexts.

Overall, the results of the present scoping review show that haptic feedback is a widespread and current topic in research on music performance, music experience and music learning. However, our search results indicate

that the investigation of concrete learning environments including technologically realized haptic stimulation is scarce. Future research should on the one hand develop affordable technological devices enabling adaptive and individually tuned haptic feedback for different fields of music learning as well as evaluate their effectiveness and learning gains compared to traditional musical learning set-ups.

References

Arksey, H., & O'Malley, L. (2005) Scoping studies: towards a methodological framework, International Journal of Social Research Methodology, 8:1, 19-32.

Barfield, W. (2010). The use of haptic display technology in education. Themes in science and technology education, 2(1-2), 11-30.

Bremmer, M., Hermans, C., & Lamers, V. (2021). The charmed dyad: Multimodal music lessons for pupils with severe or multiple disabilities. Research Studies in Music Education, 43(2), 259–272.

Burdea, G. C. (1999, June). Haptic feedback for virtual reality. In Virtual reality and prototyping workshop (Vol. 2, pp. 17-29).

Camlin, D. A., & Lisboa, T. (2021). The digital 'turn'in music education. Music Education Research, 23(2), 129-138.

Campos, P., Graham, N., Jorge, J., Nunes, N., Palanque, P., & Winckler, M. (Eds.). (2011). Human Computer Interaction--INTERACT 2011: 13th IFIP TC 13 International Conference, Lisbon, Portugal, September 5-9, 2011, Proceedings, Part II (Vol. 6947). Springer.

Cheng, F., Eddy, M., Ruiz, M.H., Großbach, M., & Altenmüller, E. (2016). Sensory feedback - Dependent neural de-orchestration: The effect of altered sensory feedback on Musician's Dystonia. Restorative neurology and neuroscience, 34 1, 55-65.

Cheok, A. D., & Karunanayaka, K. (2018). Virtual taste and smell technologies for multisensory internet and virtual reality. Cham: Springer.

Dangxiao, W., Yuan, G., Shiyi, L., Zhang, Y., Weiliang, X., & Jing, X. (2019). Haptic display for virtual reality: progress and challenges. Virtual Reality & Intelligent Hardware, 1(2), 136-162.

Debevc, M., Weiss, J., Šorgo, A., & Kožuh, I. (2020). Solfeggio learning and the influence of a mobile application based on visual, auditory and tactile modalities. British Journal of Educational Technology, 51(1), 177-193.

Dörner, R., Broll, W., Jung, B., Grimm, P., & Göbel, M. (2019). Einführung in Virtual und Augmented Reality. In Virtual und Augmented Reality (VR/AR) (pp. 1–42). Vieweg, Berlin, Heidelberg: Springer.

Dörr, B., Funk, M., Norouzinia, F., Werth, D., (2022) Haptic Learning and How It Can Enhance Digital Learning Experiences: an Innovative Approach, INTED2022 Proceedings, pp. 3909-3917.

Fletcher, M. D. (2021). Can haptic stimulation enhance music perception in hearing-impaired listeners?. Frontiers in Neuroscience, 1123.

Fontana, F., Paisa, R., Ranon, R., & Serafin, S. (2020). Multisensory plucked instrument modeling in Unity3D: From Keytar to accurate string prototyping. Applied Sciences, 10(4), 1452.

Gunther, E., & O'Modhrain, S. (2003). Cutaneous grooves: Composing for the sense of touch. Journal of New Music Research, 32(4), 369-381.

Ho, C. L., Lin, T. G., & Chang, C. R. (2022). Interactive multi-sensory and volumetric content integration for music education applications. Multimedia Tools and Applications, 1-16.

Huovinen, E., & Rautanen, H. (2020). Interaction affordances in traditional instruments and tablet computers: A study of children's musical group creativity. Research Studies in Music Education, 42(1), 94–112.

Kamińska, D., Zwoliński, G., Wiak, S., Petkovska, L., Cvetkovski, G., Barba, P. D., ... & Anbarjafari, G. (2021). Virtual Reality-Based Training: Case Study in Mechatronics. Technology, Knowledge and Learning, 26(4), 1043-1059.

Lage, G. M., Borém, F., Vieira, M. N., & Barreiros, J. P. (2007). Visual and Tactile Information in Double Bass Intonation Control, Motor Control, 11(2), 151-165.

Lin, M. H., & Chen, H. G. (2017). A study of the effects of digital learning on learning motivation and learning outcome. Eurasia Journal of Mathematics, Science and Technology Education, 13(7), 3553-3564.

Luciani, A., Florens, J. L., Couroussé, D., & Castet, J. (2009). Ergotic sounds: A new way to improve playability, believability and presence of virtual musical instruments. Journal of New Music Research, 38(3), 309-323.

Ludovico, L., Presti, G., & Saija, C. (2017). A Multimodal Sound Installation for Experiential Learning. Journal of e-Learning and Knowledge Society, 13(1).

Nanayakkara, S. C., Wyse, L., Ong, S. H., & Taylor, E. A. (2013). Enhancing musical experience for the hearing-impaired using visual and haptic displays. Human–Computer Interaction, 28(2), 115-160.

Newman, M., & Gough, D. (2020). Systematic reviews in educational research: Methodology, perspectives and application. Systematic reviews in educational research, 3-22.

Norouzinia, F., Dörr, B., Funk, M., & Werth, D., (2022). Haptic learning and technology: Analyses of digital use cases of haptics using the haptic learning model. In HCI International 2022, Gothenburg, Sweden.

Nunes-Silva, M., Janzen, T. B., Rodrigues, R. G., & Luz, A. R. da. (2021). Sensory feedback in music performer–instrument interactions. Psychology of Music, 49(5), 1285–1302.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T.C., Mulrow, C. D., … & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. International Journal of Surgery, 88, 105906.

Pala, F. K., & Türker, P. M. (2019). Developing a haptic glove for basic piano education. World Journal on Educational Technology: Current Issues, 11(1), 38-47.

Papetti, S., & Saitis, C. (2018). Musical haptics. Springer Series on Touch and Haptic Systems. Cham: Springer.

Park, H. Y. (2015). How useful is braille music?: A critical review. International Journal of Disability, Development and Education, 62(3), 303-318.

Remillard, J. T., Van Steenbrugge, H., Machalow, R., Koljonen, T., Krzywacki, H., Condon, L., & Hemmi, K. (2021). Elementary teachers' reflections on their use of digital instructional resources in four educational contexts: Belgium, Finland, Sweden, and US. ZDM–Mathematics Education, 53(6), 1331-1345.

Rochat, P., & Senders, S. J. (1991). Active touch in infancy: Action systems in development. Newborn attention: Biological constraints and the influence of experience, 412-442.

Rose, J. (2008). Listening to history: Some proposals for reclaiming the practice of live music. Leonardo Music Journal, 18, 9-16.

Ruthenbeck, G. S., & Reynolds, K. J. (2015). Virtual reality for medical training: the state-of-the-art. Journal of Simulation, 9(1), 16-26.

Sallnäs, E. L., Rassmus-Gröhn, K., & Sjöström, C. (2000). Supporting presence in collaborative environments by haptic force feedback. ACM Transactions on Computer-Human Interaction (TOCHI), 7(4), 461-476.

Senecal, S., Nijdam, N. A., Aristidou, A., & Magnenat-Thalmann, N. (2020). Salsa dance learning evaluation and motion analysis in gamified virtual reality environment. Multimedia Tools and Applications, 79(33), 24621-24643.

Tamim, R. M., Bernard, R. M., Borokhovski, E., Abrami, P. C., & Schmid, R. F. (2011). What forty years of research says about the impact of technology on learning: a second-order meta-analysis and validation study. Review of Educational Research, 81(1), 4–28.

Tom, A., Singh, A., Daigle, M., Marandola, F., & Wanderley, M. (2020, August). Haptic Tutor-A haptics-based music education tool for beginners. In HAID 2020-International Workshop on Haptic and Audio Interaction Design.

Turchet, L., Hamilton, R., & Çamci, A. (2021). Music in Extended Realities. IEEE Access, 9, 15810-15832.

Waddell, G., & Williamon, A. (2019). Technology use and attitudes in music learning. Frontiers in ICT, 6, 11.

Wallmark, Z., & Allen, S. E. (2020). Preschoolers' crossmodal mappings of timbre. Attention, Perception, & Psychophysics, 82(5), 2230-2236.

Walzer, D. (2021). Sonic thinking as a tool for creativity, communication, and sensory awareness in music production. Thinking Skills and Creativity, 42, 100953.

Zappi, V., Pistillo, A., Calinon, S., Brogni, A., & Caldwell, D. (2012). Music expression with a robot manipulator used as a bidirectional tangible interface. EURASIP Journal on Audio, Speech, and Music Processing, 2012(1), 1-11.

Zhang, Y., Li, Y., Chin, D., & Xia, G. (2019). Adaptive Multimodal Music Learning via Interactive-haptic Instrument. arXiv preprint:1906.01197.

Flipping the Learning to Engage? Herts Route to Students' Higher Levels of Learning

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Abstract: This paper looks at the application of flipped learning as a pedagogy for student learning and its blended approach to the delivery of the learning and teaching materials. This paper is based on research conducted on the delivery of a Postgraduate Business Research Methods Module. The research indicates a specific structure and sequencing is to be followed in delivering the teaching materials of the Module, providing students the opportunity to learn to higher levels, using quizzes to test knowledge and subject understanding, case studies, practical applications and student-initiated discussions. The structured synchronous online flipped learning approach, known as SOFLA, is of great importance for large modules and a big teaching team, not only to ensure consistency of delivery but also for the educational experience of mainly international students. In addition, compassion pedagogy needs to be considered to create inclusion and engagement. Mid-module feedback and end-term student voice questionnaire datasets are used in the analysis of effectiveness and student learning of the Business Research Methods Module. The conclusions drawn are an excellently designed and managed Module, giving the required learning focus, with the realisation by students that their use of learning materials and engagement is open to improvement. Recommendations are made to seek solutions to enhance student engagement in the preparation for the Module's learning materials, achieving higher learning.

Keywords: blended learning, flipped learning pedagogy, compassion pedagogy, SOFLA (synchronous online flipped learning approach), learning engagement

1. Introduction

The Higher Education sector has been living through a truly dynamic and uncertain external environment, involving the evolving delivery of higher education with a strong endorsement of both undergraduate and postgraduate students becoming financially committed to longer term financial responsibilities relating to their education. In addition, the increasing competitive alternatives such as apprenticeship schemes, requiring a review, reassessment and restructuring of educational delivery, to ensure its delivery presents value for money and delivering the provision in a futuristic and appropriately focused way. The challenges the Covid-19 pandemic has caused in terms of social engagement has not passed the education field (Blundell, et al, 2020).

From the research carried out by Lindqvist (2019), reviewing digital learning content was found by academicians to be challenging, supporting the work with paper books in the classroom (Lindqvist 2019). A further result of this educational review is the stronger emphasis on blended learning, with online delivery increasingly becoming its central focus. In addition, research carried out 3 decades ago by Kock and Korner (1977), indicated that introducing digital learning reduces interaction among students, although stimulating interdepartmental interaction, without any indications on the impact on group effectiveness.

The stronger emphasis to online delivery due to the pandemic, from an essentially campus-based and on-campus delivery University to online and subsequent blended delivery resulted in this paper's authors to consider how to incorporate these influences in further designing the University's postgraduate Business Research Methods (BRM) module and discussed in this paper. The Module's role, within the MSc International Business Programme, is to prepare the students completing a 15000- word final Major Research Project.

To create an effective learning and teaching pedagogy in this new era, flipped learning pedagogy has been adopted for the design and delivery of the module. The concept of flipped learning was formally and officially defined by the Flipped Learning Network (2014) as "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter."

2. The flipped learning pedagogy and SOFLA

Adopting the flipped learning pedagogy was to provide a transformational learning experience for the Programme and Module's predominantly international students, tending to be of Asian and African backgrounds. It further brought into focus the experience and management of students transitioning to a new academic framework and learning culture. An interesting comparison is with the findings of the 'Transforming Transitions' Project (Myhill, 2020). The 'Transforming Transitions' project conducted interviews with first year higher education/second-year further education students to better understand the differential outcomes in terms of success and retention of BTEC students compared to A-Level students (Myhill, 2020). As summarised by Huskinson et al. (2020), key challenges identified from this project included: 1) academic under-preparedness 2) awareness (but under-utilisation) of academic tutoring 3) becoming an independent learner 4) developing a 'sense of belonging' at university.

Furthermore, Deziel et al (2013) indicated the number of hours spent in classes (with little room for independent thinking) was found to have a negative impact on self-actualisation across all programmes, whereas the number of 'self -motivated' homework hours was found to have a positive impact. Moreover, engaging with empathy is a factor cited by Walther et al. (2020) that could help to engage students during their transition process, with Gilbert (2016) finding that by embedding a compassion-focussed pedagogy within seminar sessions, students became attitudinally inclined to increase efforts over time to enhance the social learning experiences of themselves and their peers. As well as signalling the presence of the academic tutor within the pre-tertiary to higher education 'transition landscape', the summary presented by Huskinson et al. (2020) provided important direction for the present research, due to dealing with international students.

The Flipped Learning Network (2014) suggests 4 pillars of FLIP must be present ensuring its learning outcomes and effectiveness. The 4 pillars are 1) Flexible Environment allowing for a variety of learning modes; 2) Learning Culture shifts teacher-centred model to a learner-centred approach with in-class time dedicated to students' active participation and engagement; 3) Carefully selected by educators' Intentional Content on what they need to teach and what students should explore on their own, to maximise classroom active learning and interaction 4) Professional Educator reflective in their practice and able to facilitate active learning and engagement. To implement the flipped learning, Moraros, et al. (2015) developed the flowchart of flipped learning structure and settings (Figure 1) which provides the foundation to follow by others in their design of flipped learning pedagogy.

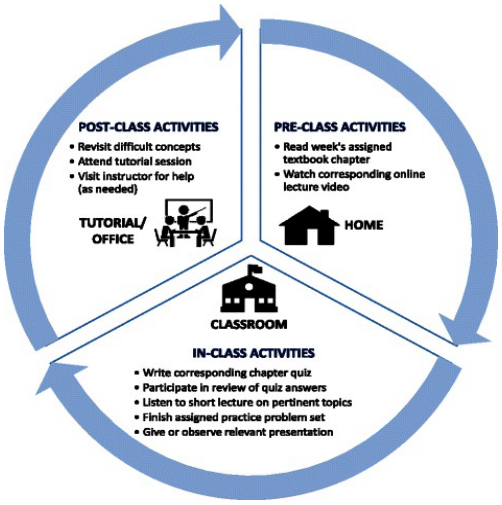

Figure 1: Flowchart of 'flipped learning' structure and settings (Moraros, et al. 2015)

A recent framework by Luo et al (2020), known as The Flipped Learning Wheel (FLW): Components and Principles (Figure 2) summarises the features of flipped learning, highlighting the role of collaborative and reflective learning. Most importantly, the FLW specifies the roles and responsibilities of the instructor and the learner, blended learning of online and face-to-face delivery. The framework also considers the accessibility and relatedness of materials, learners' engagement, collaboration, reflection and learning community, as well as instructors' feedback and support.

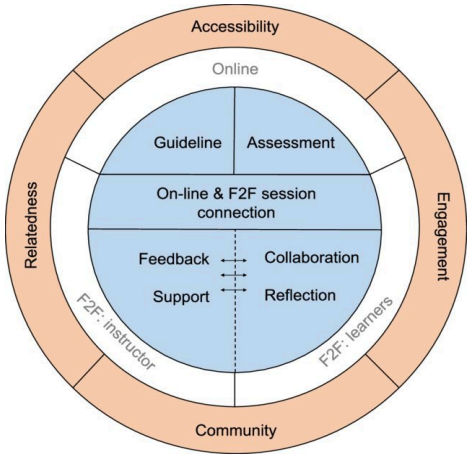

Figure 2: The flipped learning wheel (FLW): components and principles (Luo, et al, 2020)

The essence of flipped learning is about active learning with worth noting that active learning experiences being quite varied, as indicated by Wankat (2002). They often involve one or more of the following: (a) practicing or applying information through quizzes, presentations, or projects; (b) teaching others; (c) participating in engaging and challenging activities; and (d) exercising control over what is being learned or how it is learned, thus emphasising the focus on student centred learning away from instructional learning.

The effectiveness of flipped learning is proven in many aspects, such as changing student learning attitude, boosting their self-efficacy, improving academic performance, enhancing student engagement, and enriching their learning experience (Fish, 2016; Karadag, 2017; Chun and Jia, 2018; Mahasneh, 2020). Similarly, Moraros, et al (2015) in their research evaluating the effectiveness of flipped learning revealed that students find flipped learning provides them more opportunities to learn independently with flexibility before and after class; while being able to engage in critical thinking, interact with their peers, receive timely feedback/guidance from tutors in class. Accordingly, there has been growing interest and number of adoptions of flipped learning by educators in their pedagogy (Yarbro et al, 2014).

To deliver flipped learning during the pandemic, Marshall and Kostka (2020) produced a Synchronized Online Flipped Learning Approach, known as SOFLA. It is a more precise and structured model in guiding the specific activities of interaction and engagement in the e-learning process. It outlines 8 specific steps (see Figure 3) which includes all the aspects and activities proposed in the framework of Moraros, et al (2015) and Luo et al (2020).

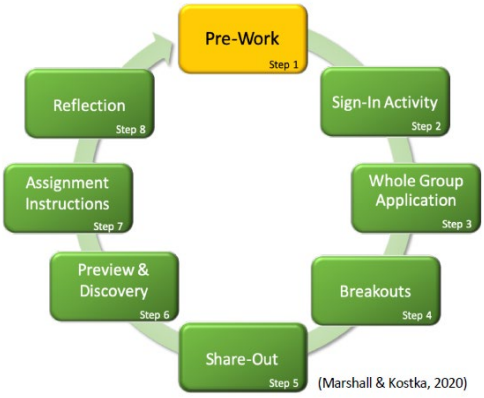

Figure 3: SOFLA model (Marshall & Kostka, 2020)

The 8 steps start from the pre-class activities known as 'Pre-Work' occurring asynchronously where students are instructed in their own time and pace. Moving to synchronous virtual sessions is the second step when the session starts with an open-ended prompt related to the lesson topic, known as 'Sign-in Activity'. Step 3 'Whole Group Application', the class will collaborate on an activity in a shared space to clarify misconceptions and/or deepen their learning of the topic. Afterwards, students will be directed to Breakout rooms and apply what they have learnt on assigned tasks. Returning from 'Breakout' is step 5 students' Share-Out while other students offer

feedback following 'SHAC' (Share, Help, Ask, Comment) protocol. Step 6 and 7 the teacher will give instructions for the coming session, not only the materials as 'Preview & Discovery' but also 'Assignment'. Finally, the synchronous session ends with an open-ended account so students can 'Reflect' that resonated with them from the lesson. This SOFLA model is adopted in the BRM module design to offer tutors and students clear instruction, guidance and consistency in their teaching and learning.

In adopting the SOFLA model it provides a consistent approach and delivery to the structure of the tutorials by means of a weekly template across all the tutorials through the 9-step structure as demonstrated in Figure 4:

Business Research Method Flipped Learning SOFLA Module Design Model				
Pre-Class Activities (*Student independent asynchronous learning*)	**Step 1: Pre-work Preparation**	Weekly core-text reading	Weekly case study / practical tasks	Weekly recorded lectures & on-campus lectures
In-Class Activities (*Tutor facilitated synchronous learning either online or F2F*)	**Step 2: Sign-In Activity**	The tutor starts with an open-ended prompt on "what this week's topic about?" and introduces the week's key topic/concept		
	Step 3: Whole Group Application	**Kahoot quiz (formative)** to check students' knowledge and understanding of the week's topic		
	Step 4: Breakout	Breakout room discussion on the case study / work on the practicial tasks (The tutor drops in different breakout rooms to facilitate and support the active community learning)		
	Step 5: Share-out	Students return from the breakouts and share their discussion outcome /practices to the whole class **using Padlet** (to record response and to be shared on the module site)		
	Step 6: Review & Discovery	The tutor discusses model answers to case studies / practical tasks		
	Step 7: Reflection	Students reflect & write down their key learning points/something to take away from the session		
	Step 8: Assignment Reminder	Weekly Canvas Quiz (10%)	Weekly Case Study Reflection (20%)	Weekly Task (Your Research) Leading to the final Research Proposal (70%)
Post-Class Activities (*Student independent asynchronous learning*)	**Step 9: Assessment Completion**	**Weekly Canvas Quiz (10%)**	**Weekly Case Study Reflection (20%)**	**Weekly Task (Your Research) Leading to the final Research Proposal (70%)**

Figure 4: BRM SOFLA module delivery (adopted from Marshall and Kostka, 2020)

3. The flipped learning and compassion pedagogy

Contrasting the flipped learning pedagogy with the University's compassion pedagogy; there are similarities in approach. Like the SOFLA Model, the study on compassion pedagogy sees the tutorial/seminar room as the appropriate space to practice cognitive progression. This is due to students working in groups on task focussed discussion - face to face, and with tutors present having an educator/mentoring role to observe and help. This is thus an indication that the two pedagogies of flipped learning and compassion have common ground in their philosophies. As shown in Figure 5, contrasting the SOFLA Model with the compassion pedagogic approach, common ground can be found in Step 2 of the SOFLA Model and Stage 1 to the approach to compassion through inclusion, as well as Stage 2 and how Steps 3-5 can be tutored, enforcing the all-inclusive culture.

Figure 5: Adaptation of compassion pedagogy (Gilbert, 2016)

Compassion pedagogy can also be regarded as inclusive teaching and learning. as HEA Academy (2017) stated it is vital to implement the inclusivity and "recognises all student's entitlement to a learning experience that respects diversity, enables participation, removes barriers and anticipates and considers a variety of learning needs and preferences". Gravestock (2017) explicitly explained inclusivity lies in "The design and delivery of teaching, learning and assessment methods that allow all students to engage meaningfully with the curriculum and achieve their full potential". Moreover, Advanced HE (2022) also advocate educators to explore inclusive culture and be innovative and deliver flexible teaching and learning.

4. The flipped learning leading to building-block design of the module

The initial design of the Module, prior to Covid subscribed to the conventional format of the reliance of pre-reading of the textbook, a didactic delivery of the lectures and assessments to follow. In response to Covid, this model was enhanced with blended learning and teaching strategy, coined with 3-stages of building-block flipped learning pedagogy with each stage linked to a summative assessment. Based on flipped learning strategy and compassion pedagogy, the module is designed as building blocks to engage students for higher level of learning. The blocks of teaching materials started to lay the foundation for adopting the principle of flipped learning and the blocks of pre-class, in-class and post-class activity – see Figure 6 below:

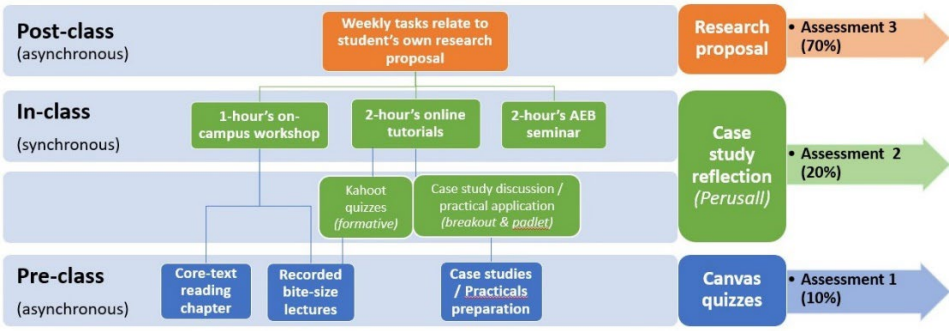

Figure 6: BRM flipped learning module design

Incorporating SOFLA, the module combines weekly pre-class, in-class and post-class activities combined with fun and relevant quizzes, recordings, case studies and practicals. What is more, all the activities are linked to formative and/or final summative assessments. The online tutorial templates were shared with 8 different tutors to ensure consistency for over 800 students on the module.

5. Research methodology

Mixed research methods were used for the collection of quantitative and qualitative data via primary research. The data were collected from two sets of a combination of closed and open-ended surveys, namely 1) the module leader team arranged Mid-module feedback workshops using Mentimeter and 2) the University's anonymous End-module student voice questionnaires. Module feedback data collected are perceived vital not only for the paper but also for the continuous development of the module. Yorke (2003) highlights the role of feedback in that "The act of assessing has an effect on the assessor as well as the student. Assessors learn about the extent to which they [students] have developed expertise and can tailor their teaching accordingly". Furthermore, Mamood-Al-Bashir, et al (2016) agree that "Good feedback practice can not only provide useful information to the students in improving their learning, but also offer decent information to teachers which is eventually to improve the learning experience for the students". Thus, whilst students' demands for feedback are met and analysed in this paper, the tutors themselves need to have insight into how students are progressing and experiencing their teaching. The tutors therefore become more involved in reviewing and reflecting on students' performance which drives them to create a better learning environment and better learning materials. This became the driving force behind having Mid-module and End-module Feedback which are presented in the paper. Both gave a useful insight into how the students were receiving and experiencing their learning.

6. Findings: The module feedback

The Mid-module feedback using Mentimeter open-ended questions from 92 students on Sem A 2021 demonstrates that students find the BRM module 'engaging' and 'interesting' and regard it as the 'most arranged module', 'one of the best modules'. However, they also find it 'challenging', 'demanding' and 'lots of reading'. Table 1 summarises the key positive and negative views of the students.

Table 1: Student feedback of the BRM module

Positives	Negatives
'one of the best module' and 'most arranged module', 'interesting', 'engrossing', 'informative', 'insightful', 'practical', 'fruitful' and 'very productive' and 'developing new ideas'	Challenging with lots of unfamiliar terminologies
Enjoyed the Kahoot quiz, module quizzes, case studies & AEB; also, the Breakout rooms	Lots of reading and reading as the least interesting part of the module

Positives	Negatives
They all spoke very highly of the module team, MLs, tutorial and AEB tutors, a few names highlighted in the attached	Breakout room with less engaging students
Students can see the 'building block design' of the module and the connection of tasks/topics within a Unit and between Units	Low engagement with pre-recorded lecture materials despite the scheduled independent learning session

In response to the module management and the building block activities designed in line with the flipped learning strategy and compassion pedagogy, Figure 7 below highlights the central themes of positive reviews with mostly over 4 out of 5 score, apart from the reading.

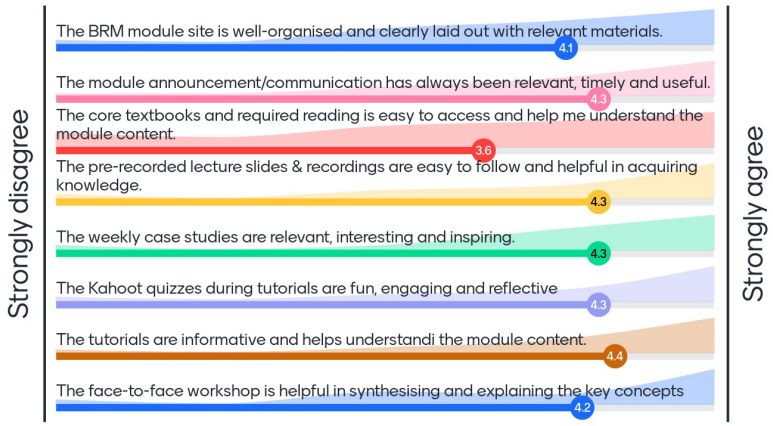

Figure 7: Responses of how the module is managed

However, Figure 8 below on students' own reflection of their engagement with the module indicates they are not good at engaging with the asynchronous pre-class and post-class activities, with all 4 activities scoring lower than 4. Meanwhile, the scores indicate they have attended well and engaged with both teacher-facilitated on-campus and online sessions.

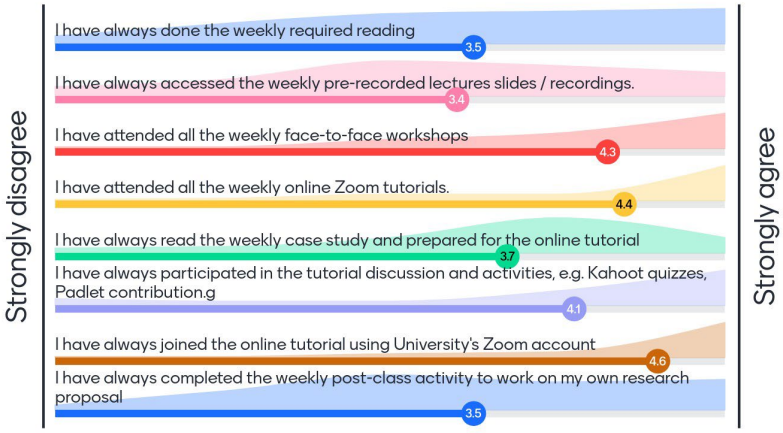

Figure 8: Students' reflection of engagement

Another 2 areas of interest from the Mid-module feedback open-ended questions are the responses to 'the most interesting part of the module' and 'areas for improvement'. Results demonstrate that students are very interested and engaged with the fun and competitive Kahoot quizzes as the most frequently occurring interesting part of the module. What is more, the inclusive AEB sessions offering contextualised, embedded and mapped (CEM) module support proved to be extremely popular too. Students found the AEB sessions helpful and made them feel they are not 'stupid' as many others have similar concerns and misunderstandings

In addition to the module's mid-term feedback, the University's end-of-term Student Voice Questionnaire based on 105 participants provides a further interesting picture as shown in Figure 9.

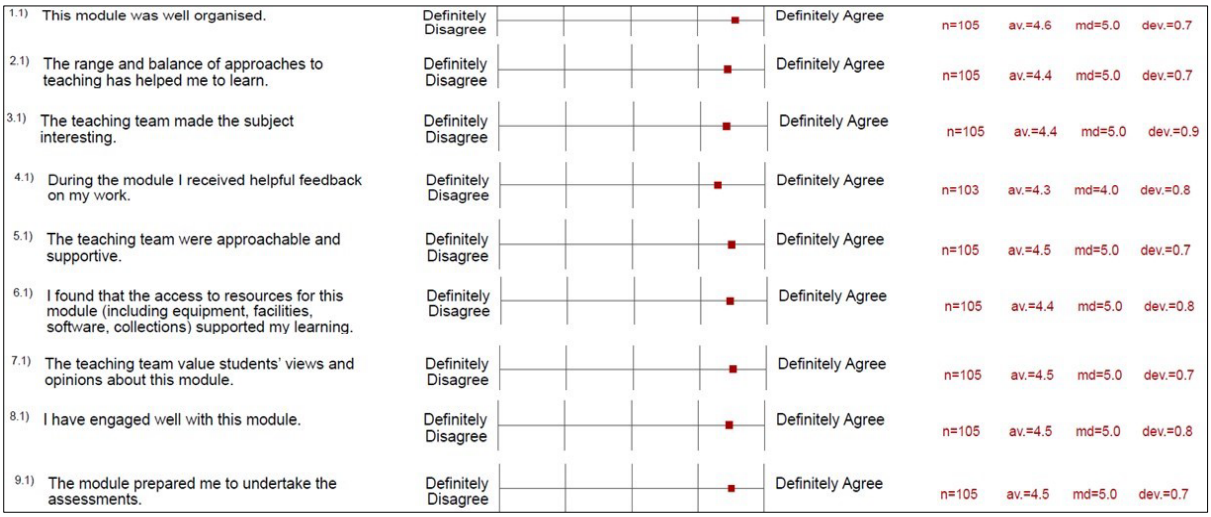

Figure 9: End-module student voice questionnaire result

Of the 9 areas, the first question relating to the organisation of the module has gained the highest means of 4.6; while other aspects are 4.5 out of 5.0 with standard deviation less than 1.0. This indicates the success of the flipped learning module design. A few supporting comments in the last open-ended question are:

- "This module was very organised and the way it was treated, it has a great topics and a lot to look into. And all the topics were arranged in a way the one and study it on their own and understand it. The lecturer was good with his work, making every lecture incredible.".
- "The module units were very well organised and all the tutorials and workshops was fully explained by my tutors to us with their best way of teaching skills which really helped all of us to understand module better."
- "The module was very well organized and very well taught. I enjoyed all the sessions especially the tutorial session with kahoot."

7. Discussion

Ultimately, the success of the flipped pedagogy is dependent on that the preparation was undertaken by the student (Burke & Fedorek, 2017), the individual characteristics of the student (Chuang et al, 2016), as well as the skills of the instructor to effectively engage the students (Whelan et al., 2016). However, there are critiques of flipped learning. Findlay-Thompson and Mombourquette (2014) claim that they are not changing the academic outcomes. Strayer (2012) suggest that students not used to the classroom being disoriented by them, which may be more significant for international students; though the research of Moraros, et al (2015) indicate international students find the flipped learning more effective than home students (North America) and more likely to be satisfied with the learning experience. Chen, et al (2014), Burke and Fedorek (2017) and Hao (2016) have identified additional weaknesses in the flipped learning approach, namely some students not favouring flipped learning, preferring to passively receive content in class. Further reinforced by Wilson (2013) indicating that although pedagogical experts recognise the superiority of student-centred learning environments, some students are reluctant to embrace a shift away from teacher directed learning (Wilson, 2013). Students' dislike is expressed in not completing the self-directed preparatory learning, characteristic of the flipped class (Burke and Fedorek, 2017; Hao, 2016) and a requirement that can generate student complaints (Hao, 2016; Whelan et al., 2016). In this research, some negative comments are mostly related to Covid than the flipping pedagogy.

From the students' feedback on the module delivery, a mixed feeling towards online, on-campus and a blended approach is evident. While some students prefer more on-campus sessions; some fear physical classes due to the covid. Some love blended and considered it a 'sensational innovation' under the current circumstance. Table 2 summarises a few comments from students:

Table 2: Student reaction to the mode of delivery

Face-to-face delivery	Online delivery	Blended delivery
Able to meet peers on campus Missing the campus University experience	"Fully online please. I've lost too many people to covid. I get scared of classes and going to public places"	the 'best during their period of covid'.

Face-to-face delivery	Online delivery	Blended delivery
Attending on-campus session helps understanding, consolidation and clarification	"Make all the classes online up to the threat of Covid 19"	"The blended learning strategy is a good idea. It makes engaging, interesting and dynamic."

Students preferring on-campus delivery may be particular relevance, as being those who are not well prepared as they disclosed in their lack of engagement for asynchronous activities. Meanwhile, fear of the Covid -19 virus is understandable, being international students away from their families. The blended learning approach maybe the way forward with emphasis on exploring technology and creating inclusive and engaging pedagogy as stated by Advance HE (2021).

Considering the key pillar of flipped learning pedagogy, namely to achieve higher order learning, it is vital that the individual learning space is emphasised and the group space is transformational in a dynamic and interactive way (Flipped Learning Network, 2014). As indicated by Wankat, (2002) teaching others; participating in engaging and challenging activities; and exercising control over what is being learned or how it is learned is a distinct ingredient in the application of flipped learning. Thus, the emphasis on for example teaching others, exercising control or how it is learned, emphasises the recognition of barriers in the practical application of flipped learning through the identification mentioned above of lack of inclusiveness experienced by BAME and international students. This enforces the value of inclusiveness, as defined in the compassion pedagogy. Thus, in Steps 3-5 of the SOFLA model, creating the inclusiveness culture of compassion and inclusion through Students considering 1) what am I doing to enhance other peoples' learning? and 2) what are others doing to enhance my learning? (Gillbert, 2016) indicates the value of compassion pedagogy in strengthening the opportunity of higher order learning by how effective the learning in the group space becomes.

However, what is the argument to enforce an approach to compassion, if not consider the value of compassion pedagogy to be an integral part of flipped learning? The study of literature in part provides the answer, suggesting that the negative impacts of communicative barriers between students in task focussed groups, are faced by BME and/or international students only. For example, in the literature on internationalising the curriculum, Turner (2009) identified that ethnocentrism amongst her local students was causing communicative barriers in their group work with international students. The local students tended to pathologise the silences in group discussions that the international students told Turner they needed if they were to find a way into these discussions. The National Union of Students Report (2009) identified from a survey of 938 BME (including international) students, that many considered their learning experiences to be negative. 23 per cent describing it as 'cliquey', 17 per cent as 'isolating'; 8 per cent as 'hostile'. International students, "frequently expressed feelings of isolation and alienation" (p5). The significance of these findings is that the Business Research Module, from the MSc International Programme cohort, consists of a high proportion of students from Indian and Nigerian and other Asian countries such as Pakistan and Bangladesh. Thus, the findings from the Turner (2009) studies and NUS Report (2009) are pertinent indicators to potential weaknesses in the learning based on the Flipped Learning pedagogy. Thus, as indicated in the NUS Report (2009) "to promote social cohesion and better integrate their student bodies" can alleviate this weakness. Thus, the combined pedagogic approach of flipped learning and compassion through inclusivity, effectively managed by the academic tutor, becomes a further key pillar in the ability to achieve higher order learning. Emphasising inclusivity is re-enforced in the Module tutor's handbook as a guide to achieving an optimum learning environment.

The critical assumption embedded in flipped learning that students can and will do the preparatory work, can be seen as the Achilles heel of the pedagogy. Lack of self-confidence in their own sense-making if not reading skills, a lack of motivation or self-organisation skills, or lack of familiarity with the language can all contribute to a lack of preparation or resentment towards preparation. Research by Masland and Gizdarska (2018) however, indicates flipped learning's success in its construct, namely that after adding a menu of options for pre-class content absorption (including, but was not limited, to video lectures), over half of the sample selected the flipped class as the preferred option. These results make sense in the context of Self-Determination Theory, which postulates that the provision of choice leads to increases in student agency, such that students are more likely to invest the effort and engagement necessary to succeed (Ryan and Deci, 2000).

The discussion indicates that 'flipped learning' has gone beyond the simplistic concept of 'flipped classroom'. It resembles the notion of 'asynchronous learning', also involving 'synchronous learning' when educators and learners are at a same time and space and considered as a form of 'blended learning' or 'hybrid learning'

(Advance HE, 2021) which the educators utilise to facilitate student-centred, interactive, and engaged learning for more effective learning outcomes (Yarbro et al, 2014).

8. Recommendations

To achieve, through analysis from the data sets, a better understanding of the behavioural and motivational aspects of students and thus develop the Module further to enhance the levels of engagement in the pre-class and in-class activities. Future research through student representatives' focus groups and continued module feedback, benefitting from the student cultural differences and its influence on engagement, regarding preparation and pre-class activities will also help to create a valued data set for further analysis and action.

References

Advance HE (2021) *Blended Learning* Available at: https://www.advance-he.ac.uk/knowledge-hub/blended-learning-0

Blundell, R., Costa Dias, M., Joyce, R., & Xu, X. (2020). "COVID-19 and inequalities", *Fiscal Studies,* Vol 41, No.2, pp: 291–319. https://doi.org/10.1111/1475-5890.12232

Burke, A. S., & Fedorek, B. (2017). 'Does "flipping" promote engagement?: A comparison of a traditional, online, and flipped class' [Online], Active Learning in Higher Education, 18(1), 11-24. *Sage Journals*, Vol 18 Issue 1, March 2017First Published April 18, 2017, https://doi.org/10.1177/1469787417693487

Chen, Y., Wang, Y., Kinshuk, & Chen, N.-S. (2014). Is FLIP enough? Or should we use the FLIPPED model instead? Computers & Education, 79, 16–27.

Chuang, H-H, Weng, C-Y, Chen C-H (2016) Which students benefit most from a flipped classroom approach to language learning? *British Journal of Educational Technology* Published online on December 01, 2016.

Chun, B. A. and Jia, H. H. (2018) 'The effect of flipped learning on academic performance as an innovative method for overcoming ebbinghaus' forgetting curve', [Online], *ICIET '18: Proceedings of the 6th International Conference on Information and Education Technology* January 2018, pp: 56–60, https://doi.org/10.1145/3178158.3178206

Deziel, M., Olawo, D., Truchon, L., Golab, L. (2013). Analyzing the Mental Health of Engineering Students using Classification and Regression. Journal of Engineering Data Mining.

Fish, A. M. (2016) "The effects of flipped learning on students in secondary education", [Online], Graduate Research Papers, https://scholarworks.uni.edu/grp/739

Flipped Learning Network (2014) *Definition of Flipped Learning,* [Online], https://flippedlearning.org/definition-of-flipped-learning/

Francl, T.J. (2014) *"*Is Flipped Learning Appropriate?", *Journal of Research in Innovative Teaching,* Vol 7, Issue 1, pp: 119 – 128.

Gilbert, T. (2016). Assess Compassion in Higher Education? Why and How would we do that? *LINK*, University of Hertfordshire, Vol 2, No.1.

Gravestock, P. (2017) *Building momentum towards inclusive teaching and learning, [Online] https://www.iop.org/publications/iop/2017/page_69352.html*

Hao, Y. (2016). Exploring undergraduates' perspectives and flipped learning readiness in their flipped classrooms. Computers in Human Behavior, 59(Supplement C), 82–92.

Huskinson, S., MacKenzie, H., Pond, K. and Goodman, R., (2020). What is success? Reflections on assisting BTEC students' transitions into higher education. *The Journal of Educational Innovation, Partnership and Change*, *6*(1).

HEA (2017) HEA framework for student access, retention, attainment and progression, [Online], https://www.heacademy.ac.uk/download/framework-student-access-retention-attainment-and-progression-higher-education.

Karadag, R. (2017) 'The effects of flipped learning approach on the academic achievement and attitudes of the students', [Online], *New Trends and Issues Proceedings on Humanities and Social Sciences,* Vol 4, No.6, p:158 10.18844/prosoc.v4i6.2926.

Kock, N.F. and Corner, J.L. (1997), "Improving university processes through computer-mediated process redesign groups", Campus-Wide Information Systems, Vol. 14 No. 1, pp. 13-23.

Lindqvist & Pettersson, F. (2019) "Digitalization and school leadership: on the complexity of leading for digitalization in school", *International Journal of Information and Learning Technology*, ISSN: 2056-4880

Luo, Z. & O'Steen, B. and Brown, C. (2020). "Flipped learning wheel (FLW): a framework and process design for flipped L2 writing classes", [Online] *Smart Learning Environments*. Vol 7, No. 10, https://doi.org/10.1186/s40561-020-00121-y.

Mahasneh, O. M. (2020) "The effectiveness of flipped learning strategy in the development of scientific research skills in procedural research course among higher education diploma students", [Online], *Research in Learning Technology,* Vol 28 *https://journal.alt.ac.uk/index.php/rlt/article/view/2327/2797.*

Mamood-Al-Bashir, M., Kabir, M.R. and Rahman, I. (2016) **"**The Value and Effectiveness of Feedback in Improving Students' Learning and Professionalizing Teaching in Higher Education", *Journal of Education and Practice*, Vol 7, No.16, pp: 38-41.

Marshall H.W. & Kostka, I. (2020). "Fostering Teaching Presence through the Synchronous Online Flipped Learning Approach", *TESL-EJ, 24*(2), 1-14. http://www.tesl-ej.org/wordpress/issues/volume24/ej94/ej94int/

Masland, L., & Gizdarska,S., (2018) "Then What Am I Paying You For?" Student Attitudes Regarding Pre-Class Activities for the Flipped Classroom", *International Journal of Teaching and Learning in Higher Education,* 2018, Volume 30, Number 2, 234-244 http://www.isetl.org/ijtlhe/ ISSN 1812-9129

Moraros, J.; Islam, A.; Yu, S.; Banow, R. and Schindelka, B. (2015) 'Flipping for success: evaluating the effectiveness of a novel teaching approach in a graduate level setting'. *BMC Med Educ,* Vol 15, No. 27, https://doi.org/10.1186/s12909-015-0317-2

Myhill,D., (2020) "Transforming transitions" [Online] University of Exeter, https://socialsciences.exeter.ac.uk/education/research/projects/transformingtransitions/

National Union of Students Report (2009), Race for Equality, [Online] http://www.nus.org.uk/en/campaigns/blackstudents/race-for-equality

Turner, Y. 2009. 'Knowing me, knowing you,' is there nothing we can do? : Pedagogic challenges in using group work to create an intercultural learning space. *Journal of Studies in International Education*, 13(2): 240–255.

Whelan, A., Leddy, J. J., Mindra, S., Hughes, J. D. M., El-Bialy, S., & Ramnanan, C. J. (2016). "Student perceptions of independent versus facilitated small group learning approaches to compressed medical anatomy Education"' *Anatomical Sciences Education,* Vol 9, pp: 40–51.

Walther, J., Brewer, M.A., Sochacka, N.W., Miller, S.E. (2020). "Empathy and engineering formation", *Journal of Engineering Education,* Vol 109, pp: 11–33

Wankat, P.C. (2002) "Improving Engineering and Technology Education by Applying What is Known About How People Learn", [Online], *Journal of SMET Education,* https://www.jstem.org/jstem/index.php/JSTEM/article/view/1235/1088

Yarbro, J.; Arfstrom, K. M.; McKnight, K. and McKnight, P. (2014) *Extension of a review of flipped learning, [Online],* https://flippedlearning.org/wp-content/uploads/2016/07/Extension-of-FLipped-Learning-LIt-Review-June-2014.pdf.

Yorke M., (2003) "Formative assessment in higher education: Moves towards theory and the enhancement of pedagogic practice" [Online], *Higher Education* Vol 45, pp: 477–501 https://doi.org/10.1023/A:1023967026413

A Personalized Approach to Flexible Learning

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Abstract: In a higher education environment massively disrupted by the pandemic, the importance of exploring the efficacy of purposeful, flexible, online learning is essential. Research shows that blended approaches to learning can be active, flexible, and student-centred. However, this research suggests that without human intervention or a bespoke context, there can also be very poor engagement. As such, this study presents the successes and challenges of introducing a personalised mobile-learning resource in a supported, personalized environment. The resource was designed and developed in 2019 and integrated in 2020 and 2021 into a large (n=200+) communication design class at an Australian university. This paper evaluates the effectiveness of the app using measures drawn from Abdullah & Ward's (2016) take on the Technology Acceptance Model. Their model, GETAMEL (general extended technology acceptance model for e-learning) measures technology acceptance factors in eLearning such as enthusiasm, self-efficacy, and student enjoyment of technology in relation to contextual purpose. This paper also considers the value of self-directed learning and co-curricular activities in the context of additional learning to support core curriculum. This paper presents an evaluation of student experience drawn from a class-wide survey and analysis of usage data. We conclude that the use of a personalised app fosters an autonomously supportive experience that leads to intrinsic motivation and improves overall learning (Baker & Goodboy, 2018). The app provides additional support for students unable to attend tutorials and enabled students to remain engaged and abreast of the general topics each week and provided some additional prompts about self-directed learning activities they could engage in, that they wouldn't have otherwise had. Enjoyment, as one of the key factors of the GETAMEL model, was explicitly mentioned by students. While a personalised tool is labour intensive and expensive in cost and time, this study concludes that the rewards regarding student experience make it worthwhile.

Keywords: personalised learning, GETAMEL, technology acceptance model, flexible learning, mobile app

1. Background

Delivering learning activities in higher education that are personalised to the learner is generally a challenge. We often rely on off the shelf solutions to support student's technical learning. While these solutions support our learners, the impact varies, for students at different skill levels, for students who are non-native English speakers, and for students who would benefit from targeted tutorials or one to one support. In this paper, we share the success and challenges of introducing a personalised mobile app to support autonomous learning. The students in this study use Adobe Creative Suite as part of their course activity and assessment. In 2019, we developed a personalised mobile application (app) to support a large design class (200 plus students). This app was used to support new cohorts in 2020 and 2021. The app was used synchronously with face-to-face classes initially and then asynchronously as classes moved to fully online during the Covid-19 lockdowns.

On this design course, it is generally expected that students have a working knowledge of Adobe Creative Cloud software applications. However, the reality is wide variations in ability across the cohort. Although students have free access to a wide range of generic training, such as video tutorials on LinkedIn Learning and You Tube and the help that comes with the software, student feedback suggested that the videos were too generic and too long. Our students reported being overwhelmed by the length of videos and frustrated at having to sift through the content to find support relevant to the course curriculum. They were also confused when directions or terminology did not align with the teaching materials. This encouraged the course team to design a mobile app to serve as co-curricular support.

The app was designed on the Articulate 360 platform and consists of 23 bite-size learning activities organised across 10 weeks of learning. Learning activities are aligned to course content and are interactive. They consist of a mix of self-assessment activities, definitions, and keywords. The app is interactive and allows students to hover over specific areas in order to receive guidance. The app is designed to offer a range of learning activities

such as matching exercises, step-by-step tutorials, demonstrations, quizzes and diagrams that explain relevance supported by how-to videos.
This study considers the impact and effectiveness of this personalised app though an analysis of survey data and student usage. Evaluation of the data is based on student experience in relation to evidence-based practice. The following literature review considers student motivation and autonomy, the eLearning technology acceptance model and approaches to m-learning.

2. Literature review

It has been suggested that personalised learning can overcome barriers including age, gender, motivation, and self-efficacy (Rabin et al., 2020). Indeed, personalised learning can often improve student satisfaction and offer a rewarding and autonomous experience for learners (He et al, 2019). Giving students autonomy over their learning enables intrinsic motivation which improves engagement with learning generally (Baker & Goodboy, 2018). Cochrane et al (2017) also found that giving learners control of the navigation and pace of their learning has a positive impact on student engagement and motivation. Furthermore, we know that aligning learning activities to learning outcomes and assessment also positively impacts student behaviour and motivation (Biggs & Tang, 2011; Garrison, 2011; Laurillard, 2002).

When using the app, students are expected to identify their own knowledge gaps and take responsibility for self-directed learning (Picciano, 2009, p. 2). Self-directed learning enables students to diagnose their own learning needs and set their own goals for learning (Knowles, 1975). Developing strategies for self-directed learning in higher education is important because it supports the motivation to learn and affords a sense of self-belief for the learner (Boling et al., 2012; Santhanam et al, 2008). Additionally, the design of eLearning activities should offer users choice in ways to engage, in order to support self-efficacy and motivation (Chen et al, 2015). Otherwise, learners remain passive if they are not given "genuine choices with regards to what, when, and how they learn" (Amponsah et al, 2019, p. 88). Indeed, we found this to be the case, students end up frustrated if the consider the support as too vague. This means that choice of activities, targeted learning and well-designed navigation are needed to support learner autonomy.

One of the key issues of introducing e-learning successfully in higher education is making sure that the tools and technologies are purposeful for the learner. Indeed, it has been found that students are more likely to view online support modules positively when they exist to support core learning (Yeoh et al, 2017). Traditionally, the technology acceptance model (TAM), a behaviour-based framework, is used to evaluate how users will engage with technology and be receptive towards using it. TAM essentially focuses on three factors: perceived ease of use (PEU), perceived usefulness (PU) and the attitude towards use (Davis, 1989; Granić & Marangunić, 2019; p 2574). Over time, TAM has been further extended to include additional relationships, for example, social influence and trustworthiness (Abdullah & Ward, 2016; Venkatesh & Davis, 2000). While TAM is a criticized framework regarding information systems development, it is reasonable to suggest that this framework has influenced systems design for many years (Granić & Marangunić, 2019). In higher education, TAM has been adapted by education communities as a "common ground theory" in the acceptance of e-learning literature (Abdullah & Ward, 2016; Granić & Marangunić, 2019, p. 2575).

In their extended review of e-learning adoption in higher education, Abdullah & Ward (2016) adapt the TAM framework into a version entitled GETAMEL (general extended technology acceptance model for e-learning) (Abdullah & Ward, 2016, p. 238). The GETAMEL framework breaks down the common factors of perceived usefulness (PU) and perceived ease of use (PEU) into the predictors for how students will engage with e-learning. This helps to identify what motivates our students to use a new e-learning tool. For the purpose of this study, the GETAMEL predictors align with the concept of contextual (personalized) design and intrinsic motivation.

In the GETAMEL framework, the key reasons for perceived usefulness (PU) of an eLearning app include student sense of enjoyment in using it, their expectation that it needs to be used (which often comes from peers and tutors), their confidence in being able to use the tool (self-efficacy) and their prior experience with similar interfaces. The key factors for perceived ease of use (PEU) of an eLearning app also include self-efficacy, enjoyment, previous experience with similar, expectation that it should be used and a lack of fearfulness or anxiety about using it (Abdullah & Ward, 2016). These were identified as appropriate measures from which to consider how students in this study engage with and view the app as part of their learning.

Finally, the app is designed to be used on a mobile phone, we know that purpose-built applications like this can maximise a smartphone's affordances for mobile learning (m-learning). Geddes (2004) defines m-learning as "the acquisition of any knowledge and skills through the use of mobile technology, anywhere, and anytime" (p.1). While familiarity with the platform will support perceived usefulness and perceived ease of use, studies have also found that lower levels of English language proficiency and lack of technological skills can negatively impact success of eLearning (Geduld, 2019). However, we believe that the potential for visual communication as a personalised learning mechanism, that breaks down such barriers, is not always recognised (Müller, 2007). We believe that a visual and interactive app, such as the one created, offers a more visual medium that can increase clarity and transcend language barriers (Carbonell, 2016).

3. Research methods

This research was undertaken by survey and the evaluation of student usage data. Students were invited to participate via email. 80 students took part in 2020 and 62 students took part in 2022. The surveys consist of 6 demographic questions, 10 Likert scale questions focused on self-directed learning and an additional 10 Likert scale questions about use of the app and generic off the shelf support. Students were given an opportunity to add qualitative comments to their responses. The analysis of student usage used basic analytics to establish the number of times the app was accessed and timing of that access.

4. Analysis

4.1 Analytics of student usage

We found that use of the app coincided with days where synchronous learning activities occurred. In 2020, tutorials were timetabled on Wednesdays with one tutorial on a Thursday. 36% of use for the week was observed on a Wednesday. The next highest usage was on a Tuesday with 14%. Therefore, 50% of use happened before, during, or after tutorials on days when students were either preparing for these tutorials, consulting the resource during them, or refreshing what had been covered after these tutorials. The survey data supports this finding, students report relying on the app as a supplemental learning source before and/or after class.

> *I would mainly use it before the tutorials, so I was able to prep myself and expect what was going to happen in the tutorials…. I would use it afterwards because it's more like refreshing my memory for the assignment. (Student with limited experience of Adobe)*

For both years, analysis of analytics re usage indicate that the app was used more in the first half of the semester and again when assessment was due. The app was used at least once or twice a week at the start of semester and once a week towards the end of semester on both years. Student usage also indicate that 92% of student accessed the app at least once. In the qualitative data from the survey, students support this finding,

> I like to start things straight away at university in the week before the semester starts. I usually try to do as much as I can so that I don't fall behind 'cause it feels like a constant rat race, so I remember when the app lessons first came out, I literally did the whole thing in like 2 days or a day and a half. (Student confident of using Adobe)

4.2 Support for autonomous learning

In the survey analysis, 76% of respondents agreed that the app was helpful to their learning. 21% felt indifferent towards the app and 3% said it was not helpful. 93% of respondents agreed that being able to revisit materials helped their learning. 81% of respondents agreed that being able to work at their own pace helped their learning. 90% of respondents agreed that they enjoyed having access to the resource outside of synchronous class times.

4.3 Generic v personalised

Less than half of the students surveyed had tried generic resources to support their understanding of Adobe Creative Suite. Students with limited experience were more likely to use both personalised and generic tools. Those that had used the generic resources found them generally useful. However, within this smaller group, they found the course app to be more relevant, cohesive, and consistent compared to LinkedIn Learning or You Tube. The lack of focus and information overload in the generic solutions was a turn-off for students although they did express an appreciation for the high production quality of the resources. Comments included

> *I was quite put off by the LinkedIn videos just as soon as I saw how long they went for as I was like, oh God, I don't have time for that. Whereas, with the course app, you don't have to do the whole thing. You can see what you want to get out of it. In contrast, with the LinkedIn ones, you have to watch the whole*

broad video and then from that, you might only get like two things that you actually wanted to ask about. Yeah, so you're just not wasting your time I think, with the course app.

Students were pleased to have access to personalised learning and found the course app supported the learning activities and helped deepen understanding. This was particularly notable around concepts, terminology and processes that are known by specific names in industry and in core curriculum. Students also found the course app more credible.

I think I sort of trusted it [the bespoke learning resource] a bit more because it felt like it was made by you for me as opposed to very general random videos that might be on the subject area, but perhaps not all of it's necessary to the assignments we're doing. I felt like the Pocket Tutor was all just necessary information and because it was necessary information, that's going to motivate me to actually listen to that properly and know that all of what I'm listening to and reading here is vital.

I found it [the course app] a lot more helpful than I found LinkedIn learning videos and resources like that. It's got those little diagrams and stuff in it and it sets out what you need to do. I'm very task oriented when I do stuff. So, the way the course app was set out was sort of like these are all the things that you need to do for this week. And these are all the steps you need to take, and it helped set it out for me really clearly. And I really liked that and the practical aspect of going through it and then practicing it while I was going through. As opposed to like learning from a video and then having to go back through the video when I encountered certain problems again.

Students also suggested that the course app helped them to manage expectations which reduced stress and increased self-efficacy. The main barriers that emerged from the survey data was the additional distractions that come from a mobile phone. Students suggested that unintended distractions, including news alerts, message notifications, and phone calls interrupted their learning.

4.4 Student insights

Students overwhelmingly suggested that the target audience for the course app are those who were brand-new to the software or those who hadn't used the software in some time and needed a refresher. This extended to students who had missed tutorials and would otherwise be behind or confused without such a resource. They saw the value of it as extra-curricular support that freed up valuable time with the teaching team

The course app is great for students who maybe can't always pay attention in the lectures. Sometimes I'll miss what [the professor] says. I'm not always present in the lectures, all the way through, and that's why it is good. I like the short ways to learn. The short videos are good. I can't concentrate for a whole lecture.

Students suggested that the app was a safe space to explore, feel more comfortable with, and get initial questions answered without having to risk asking questions in class. 71% of students who said they experienced anxiety regarding the technical requirements of the course used the app

I think the app is ideal if you didn't like the in-person style. If you were an introvert or classes were too overwhelming for you. Maybe if you had social learning difficulties as well. I can imagine not everyone feels as comfortable talking to their tutors. So I think that the app would probably be really good for them cause they don't have to go through that awkward interaction in person.

5. Discussion and conclusion

Overall, the integration of a personalised learning resource can be seen as useful and warranted in a skills-based and technology heavy, higher education course. The app is not a replacement for curriculum, learning activities or content, but an opportunity for students to self-learn technical applications through a scaffolded and context specific approach. The benefit of this personalised approach over off the shelf, generic solutions has been clearly identified in this study. The personalised approach offers consistency with the core curriculum and industry and discipline specific terminologies. This enables deeper understanding about core concepts and develops students' self-belief in their ability to use the technologies to support their learning. Offering a personalised approach to learning makes content more relevant for learners, affords opportunities to ensure that learning supports the diversity of the student cohort and encourages and motivates students to learn. The relevance of this app was highlighted through the high number that used the resource (92%) as opposed to less than half of the cohort using the off the shelf support from LinkedIn Learning or You Tube.

The flexibility regarding access is important, m-learning offers opportunities for students to access the resource at times that suit them and offers ease of use**.** It adjusts to varying screen sizes and although students did report some distractions from their devices overall, their experience with the app was considered valuable. The analysis of student's usage indicated that students used the supporting resources before and after synchronous classes

and at times when the teaching team staff were unavailable such as evenings or weekends. This helped to increase students' autonomy and self-directed learning potential (Baker & Goodboy, 2018) and helped to reinforce their learning. Additionally, the personalised learning was considered of benefit to those that could not attend synchronous sessions, which has positive implications for post covid learning and the flipped classroom.

Furthermore, this research demonstrates that students are willing and motivated to engage with extra-curricular learning activities if they are assured that it is of value and supports their core learning. They explicitly mentioned that the app was enjoyable, and enjoyment is one of the key factors of the technology acceptance model. Overall, the mobile app addressed key factors of perceived usefulness (PU) and the perceived ease of use (PEU), students enjoyed using it, and were confident using it because it aligned with expectations set by the teaching team, and it became part of the normal experience of course learning. Moreover, the mobile app supported students to find the PU and PEU of the Adobe Creative Suite which is essential to their ability to deliver good outcomes for assessment.

Finally, it is important to acknowledge that the development of the app was part of a graduate certificate course that one of the authors of this paper was enrolled on. Development, design and refinement of such a tool is a significant endeavour, as is the ongoing maintenance and upkeep which is not an issue when using generic learning resources like LinkedIn Learning however while there is rarely time allocated to develop such a resource, the evidence that has been gathered over two years of usage and survey data offers a compelling argument for creating and maintaining personalised learning to enable additional confidence in students with tech-heavy and skills-based university classes and to allow them to take more ownership over and responsibility for their learning. Ultimately, a personalised tool is not cheap from a labour, expertise, or time perspective; however, the overall rewards are worthwhile from a relevance, cohesiveness, engagement, and retention perspective.

References

Abdullah, F. and Ward, R. (2016) "Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors", *Computers in Human Behavior*, Vol 56, pp 238–256. DOI:10.1016/j.chb.2015.11.036

Amponsah, S., Badu-Nyarko, S. K., Obodai, G. A. N. S., and Anane, P. (2019) "Learning Environments for Supporting Undergraduate Online Distance Education Students". In M. M. v. Wyk (Ed.), *Student Support Toward Self-Directed Learning in Open and Distributed Environments* (pp. 78). Hershey, PA: IGI Global.

Baker, J. P. and Goodboy, A. K. (2019) "The choice is yours: the effects of autonomy-supportive instruction on students' learning and communication", *Communication Education*, Vol 68, No. 1, pp 80–102. DOI:10.1080/03634523.2018.1536793

Biggs, J. and Tang, C. (2011) *Teaching for Quality Learning at University*. Maidenhead, UK: Open University Press.

Boling, E. C., Hough, M., Krinsky, H., Saleem, H. and Stevens, M. (2012) "Cutting the distance in distance education: Perspectives on what promotes positive, online learning experiences", *The Internet and Higher Education,* Vol 15 No. 2, pp 118-126. DOI: 10.1016/j.iheduc.2011.11.006

Carbonell, R. (2016) "Comic contracts". ABC Law Report. https://www.abc.net.au/radionational/programs/lawreport/comic-contracts/7898330

Chen, L., Chen, T. L. and Chen, N. S. (2015) "Students' perspectives of using cooperative learning in a flipped statistics classroom", *Australasian Journal of Educational Technology,* Vol 31, No. 6. DOI:10.14742/ajet.1876

Cochrane, T., Sissons H. and Mulrennan D. (2017) "Creating Time and Responsive Dimensions in Science with Mobile Technology" in Helen, C., and John, T. (2017). *Mobile Learning and Higher Education: Challenges in Context* (1st ed.). Routledge.

Garrison, D. (2011) *E-learning in the 21st century: a framework for research and practice* (2nd ed.). Routledge.

Geddes, S. (2004) "Mobile Learning in the 21st Century: Benefits for Learners", *Knowledge Tree: an e-journal of flexible learning in VET*. http://hdl.voced.edu.au/10707/383787.

Geduld, B. W. (2019) "Developing Self-Directed Learning to Cope with Open and Distributed E-Learning". In V. Wyk, M.M. (Ed.), *Student Support Toward Self-Directed Learning in Open and Distributed Environments* (pp. 103). Hershey, PA: IGI Global.

Granić, A, & Marangunić, N. (2019) "Technology acceptance model in educational context: A systematic literature review". *British Journal of Educational Technology*, Vol 50, No. 5, pp 2572–2593. DOI:10.1111/bjet.12864

He, W., Holton, A., Gu, H., Warschauer, M. and Farkas, G. (2019) "Differentiated Impact of Flipped Instruction: When Would Flipped Instruction Work or Falter?", *International Journal on Teaching and Learning in Higher Education*, Vol 31, No. 1, pp 32–49.

Knowles, M. S. (1975) *Self-directed learning: A guide for learners and teachers*. New York: Association Press.

Laurillard, D. (2002) *Rethinking university teaching: a conversational framework for the effective use of learning technologies* (2nd ed.). London: Routledge Falmer.

Müller, M. G. (2007) "What is visual communication? Past and future of an emerging field of communication research". *Studies in Communication Sciences,* Vol 7, No. 2, pp 7-34.

Nelson, D.L., Reed, U.S. and Walling, J.R. (1976). Pictorial superiority effect. *Journal of Experimental Psychology: Human Learning & Memory,* Vol 2, pp. 523-528. DOI: 10.1037/0278-7393.2.5.523

Newby, T. J., Stepich, D. A., Lehman, J. D., & Russell, J. D. (2000) *Instructional Technology for Teaching and Learning.* New Jersey: Prentice Hall.

Nicholson, P. (2007). A History of E-Learning. In: Fernández-Manjón, B., Sánchez-Pérez, J.M., Gómez-Pulido, J.A., Vega-Rodríguez, M.A. and, Bravo-Rodríguez, J. (eds) *Computers and Education*. Springer, Dordrecht. DOI:10.1007/978-1-4020-4914-9_1

Picciano, A. G. (2009) Blending with purpose: The multimodal model, *Journal of Asynchronous Learning Networks,* Vol 13, No. 1, pp 7-18. DOI:*10.24059/olj.v13i1.1673.*

Rabin, E., Henderikx, M., Yoram, M. K. and Kalz, M. (2020) "What are the barriers to learners' satisfaction in MOOCs and what predicts them? The role of age, intention, self-regulation, self-efficacy and motivation.' *Australasian Journal of Educational Technology*, Vol 36, No. 3, pp 119-131. DOI 10.14742/ajet.5919

Santhanam, R., Sasidharan, S. and Webster, J. (2008) "Using self-regulatory learning to enhance e-learning-based information technology training", *Information Systems Research.* Vol 19, No. 1, pp 26-47.

Venkatesh, V. and Davis, F. (2000) "A theoretical extension of the technology acceptance model: Four longitudinal field studies", *Management Science*. Vol 46, No. 2, pp 186-204. DOI 10.1287/mnsc.46.2.186.11926

Yeoh, M. P., Cazan, A., Ierardi, E. and Jacic, L. (2017) "Facilitating self-directed learning (SDL) and satisfaction with SDL among pre-university students". *Educational Studies.* Vol 43, pp 584-599*.* DOI:0.1080/03055698.2017.1343711

Filling Voids in Japanese EFL Programs With Bricolage, MAYA, and Intentional Space

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Abstract: Japanese universities and their EFL programs, when seen together, one may get a general sense that policy aims and actual effects show high-sounding slogans with results mainly in the opposite direction (Yoshida, 2019). A lack of a unified approach to EFL education can be explained at the program level when the following three terms are considered: 1) Bricolage, 2) the MAYA Principle, and 3) Intentional Space creation. Professors, often from eclectically different backgrounds, who are charged with curriculum design, hiring and training, and implementing their EFL program need to recognize their shared participation as something within an entire that will always be larger than the sum of what they can contribute. Hence the use of the term bricolage. Bricolage is a French loanword that means the process of improvisation in a human endeavor. The word is derived from the French verb bricoler, to tinker, with the English term DIY ("Do-it-yourself") being the closest equivalent. MAYA stands for: "Most Advanced, Yet Acceptable," a principle initially constructed by industrial designer Raymond Loewy. MAYA provides users, product consumers, teachers, students, coaches, and literally anyone with enough of what they already use and understand with enough new features that are easy to adopt ("Design - Raymond Loewy the first real Mad Man," 2017). MAYA is never applied nor experienced in a vacuum, always within a predetermined space. Within educational settings, MAYA needs to be applied not just in a classroom but to intentional spaces that include and go beyond the classroom. Creating an intentional space is about validating the students and making them feel valued and belong. It is also about building a dynamic, informed community applicable to learners' lives (Bauwens, 2008). So, what makes an EFL program good? Everyone working hard for the students? Is it teaching in an informed, smart manner? These questions and others were shared and discussed at a medium-sized university's EFL program in Japan. Survey results and discussion outcomes will be shared along with case study-like anecdotes and vignettes.

Keywords: Japan, EFL, administration, bricolage, Raymond Loewy, Intentional Space

1. Background

Many teachers believe they have all they need with the teacher's book. With a textbook in hand and handouts printed, teachers are ready. Always at hand is a chalkboard for quickly illustrating essential points. Such were the days of a now bygone era. We no longer live strictly in an analog world. Our students are increasingly digital natives. In light of that, they will compare and rank their technically savvy teachers to those who are not.

Moreover, some may have reached a point in their professional career and development that would lead them to say: "A gap fill is a gap fill is a gap fill!" By this comment, one can infer that the speaker must have sufficient knowledge and will do just fine in their medium of choice where they are proficient and comfortable. Suppose Computer-Assisted Language Learning, CALL, is not a part of that teacher's toolkit. In that case, the learners will never experience gap-fills on unimaginable levels, on their hand-held devices, and in unlikely places like buses, subways, and student lounges. With the possibility of frequent access, the learner's chances of recirculating already familiar linguistic information increase. No one is suggesting that such a teacher is not working hard, but one can ask how well that teacher's reach could extend with innovative aspects of available and tested technology.

There would be no need to write if this were an isolated problem. Nevertheless, Japanese universities and their EFL programs show that policy aims and actual effects are often divergent, high-sounding slogans with results in the opposite direction (Yoshida, 2019). Yoshida concludes that such a state can be squarely blamed on the Japanese Government, with its unreasonable policies and untenable expectations (Yoshida, 2019). Development in a positive direction at the program level can happen when whatever people of differing backgrounds see complies with what is most advanced yet acceptable for them and their program. Once that happens, creating intentional spaces for teaching and learning can occur.

2. Framework

A lack of a unified approach to EFL education can be explained at the program level when the following three terms are considered: 1) Bricolage, 2) the MAYA Principle, and 3) Intentional Space creation. Professors, who often come from different backgrounds, and are charged with curriculum design, hiring and training, and implementing their EFL program, need to recognize their shared participation as something within an entire that

will always be larger than the sum of what they can contribute. Hence the use of the term bricolage to describe this situation. *Bricolage* is a French loanword that means the process of improvisation in a human endeavor. The word is derived from the French verb bricoler, tinker, with the English term DIY ("Do-it-yourself") being the closest equivalent. MAYA stands for: "Most Advanced, Yet Acceptable." It is a principle initially constructed by industrial designer Raymond Loewy. MAYA provides users, product consumers, teachers, students, coaches, literally anyone - with enough of what they already use and understand with enough new features that are easy to adopt ("Design - Raymond Loewy the first real Mad Man," 2017). MAYA is never applied nor experienced in a vacuum, always within a predetermined space. Within educational settings, MAYA needs to be applied not just in a classroom but to intentional spaces that include and go beyond the classroom. Creating an intentional space is about validating the students and making them feel valued and belong. It is also about building a dynamic, informed community applicable to learners' lives (Bauwens, 2008). So, questions emerge: What makes an EFL program good? Everyone working hard for the students? Is it teaching in an informed, smart manner? These questions and others were shared and discussed at a medium-sized university's ESL program in Japan. Survey results and discussion outcomes will be shared with case study-like anecdotes and vignettes.

2.1 Bricolage

The lack of a unified approach may be partly due to the eclectic cobbling of full-time teachers who design the curriculum. Someone with a background in applied linguistics or pragmatics may focus on computer-assisted language learning. This person is set together with someone with teacher certification and ten years of experience teaching high school English. However, not to forget another who has an advanced, if not a terminal degree, in English literature while another with no special training or certification in education is simply a native speaker. When seen as a whole, one can see a motley bunch. Consistency has to be a shared concern. When a team recognizes their shared responsibility, the members need to see themselves within an entire that will always be larger than the sum of what they can contribute. Such a contextual milieu needs to be recognized and named for what it is, a bricolage environment.

The bricoleurs construct theories by arranging and rearranging, negotiating, and renegotiating with a set of well-known materials (Turkle and Papert, 2016). Bricolage combines diverse theoretical traditions that lead to insights into sociological and educational phenomena (Lise, 2013). For this research, the “Point Of Entry Text” is the hiring practices of full-time and part-time instructors within Japanese universities.

Redfield 1990 describes standard hiring practices for Japanese and international instructors. Even today, this still holds in practice. Generally speaking, Japanese universities hire their faculty through a recommendation system known as the “Old Boys” or “OB” network (Redfield 1990). While there may be a system for recruiting, positions may be publicized, and formal qualifications are required. Depending on who comprises the search and nominating committee, these may be mostly for show.

A recommendation from the proper person is the key: for full-time positions, this proper person is usually Japanese. In practice, the candidate majors typically in English and, upon graduation, immediately enters a Ph.D. program. TEFL programs in Japanese universities may not be as pervasive as literature or linguistics at the departmental or program level. Therefore s/he will have specialized in either literature or linguistics.

Through the university’s own or a broader “OB” network, if the graduate professor comes from a different school or is involved in one of the many learned societies that proliferate in Japan, information about jobs becomes available, and telephone calls are made; jobs are firmly secured. All this happens well before the job seeker makes a formal application.

Convinced of the desirability of an aspirant, the professor informs their colleagues; if there are no other applicants, the person is hired. If there are two or more aspirants, the one whose backing comes from the most seniority is selected. Realizing that an appointment for a full-time faculty position is a decades-long commitment, one can see how EFL programs in Japanese universities can be underachieving. The leaders hired have little knowledge, background, or interest in TESL/TEFL-related program development and implementation.

This process holds in the case of part-time positions - upon which the bulk of the classroom-level instruction depends.

At its best, bricolage is a way to learn and solve problems by trying, testing, and playing around. When seen in the context of hiring for language educator positions in Japanese universities, the hiring problem is solved. Trying and testing are done within limited circles. It can make one wonder about the extent of "playing around" more with self-image and ego rather than finding the most qualified candidate. With the selected candidate comes the reality that if the new person does not work out, it is the fault of the key person who recommended and pushed for that person, not the committee. The dabbling continues with a tamping down of expectations to maintain harmony and save face for all concerned. So, depending upon who sits on the search committees and who has the most seniority to recommend will determine the profile of an English language program for decades. Nothing is assured, but whoever comes will likely result from someone's situational feelings. Another topic is whether or not such a new person can function in or manage a university English program.

2.2 MAYA Principle

With bricolage, another concern that may explain why a particular English program may be underperforming is the MAYA Principle. MAYA stands for "Most Advanced, Yet Acceptable." It is a principle that provides users with enough of what they already use and understand with enough new features that are easy to adopt. To quote: "The adult public's taste is not necessarily ready to accept the logical solutions to their requirements if the solution implies too vast a departure from what they have been conditioned into accepting as the norm."- Raymond Loewy (Pringle and Field, 2009) (CMG Worldwide, 2020).

Raymond Loewy (November 5th, 1893 - July 14th, 1986), considered the inventor of industrial design, has had an unmistakable impact on the daily life of people, especially those who live in the United States. One of his most iconic designs is the livery for Air Force One, the paint scheme for every US President's jet since Kennedy. However, perhaps his most familiar is his redesign of the Coke bottle ("Design - Raymond Loewy the first real Mad Man," 2017).

An example of MAYA in action within a university's English program can be seen when an instructor decides to implement the use of Moodle at the program level, not just at the incidental teacher-to-class level. One should not be surprised by outright rejection for various reasons, none of which fall beyond MAYA.

An argument for adopting Moodle is that teachers can extend their reach. Moodle has a proven track record for being flexible, time-saving, and efficient for monitoring student progress. By blending print and digital materials, students and instructors can benefit alike.

With the advent of handheld devices, user plans with unlimited data access, and wifi networks, the need for paper, arguably, has passed. Teachers no longer need to make corrections on submitted paper-based assignments. When assignments and quizzes have feedback set up to be visible after an attempt, the students receive their feedback. Students can practice their English more both in and outside of class by using smartphones, tablets, or laptops as long as they are connected at least to a wifi network (Goetz, 2012).

Sadly, this was not what happened and became a problem for those who initially rejected adopting Moodle skills well before the pandemic.

Goetz 2018 reports that when Readiness quizzes (RQ) are set up as gateway quizzes to raise awareness of class rules and expectations, the DWF rates drop, whereas DWF refers to *Dropout, Withdrawal,* and *Failure*. Concerning MAYA, those teachers who tracked student progress with RQ completion had lower DWF rates. This topic was introduced, discussed, and adopted during the annual teacher orientation meeting to benefit at-risk student populations and teachers who will not have to teach as many repeating students in subsequent years. The setup of the Readiness quiz for students included the caveat that it opened up access to the first two of six Preparation quizzes. The course had six units; therefore, all had Preparation quizzes and Review quizzes. Unit Tests were available if a teacher wished to use Moodle for course midterms. To access a Unit Test on the midterm day, the student must have completed the corresponding Review quiz. Moreover, they needed to have finished the Preparation quiz, which, in the case of the first two units, required having done the Readiness quiz.

Students who did the Readiness quiz tended to do their Preparation and Review quizzes on more of a weekly basis. Teachers who saw the value of the RQ could see the benefit for their students and themselves. Student benefit was that they were on time and focused on their studies and teacher benefit included knowing that all

or nearly all students would not only pass but receive earned and informative grades. MAYA applied well here. Beyond an in-class mention, those who did not use the RQ found this setup too advanced and unacceptable. Subsequently, their students were more likely to procrastinate in doing their other required Preparation and Review quizzes by the semester's end (Goetz, 2018).

2.3 Intentional Space

Within a bricolage environment and concerted effort to engage the MAYA Principle, creating an intentional space becomes the next focus point for filling the voids that define ineffective EFL programs in Japanese universities. The previous example of introducing Readiness quizzes worked but not for all. It failed most among the teachers for whom the idea of a Readiness Quiz was too advanced and unacceptable. To bring MAYA to all members, they need to be included by validating them, the students, and the teachers. Creating an intentional space makes them feel like they belong (Bauwens, 2008). It is building community. *Intentional spaces* are defined as a space created "with a specific intention for supporting and nurturing one another, expanding awareness, and empowering transformative action" (Seale, 2017). It is a space created within an informed, applicable, dynamic and where their ideas matter. Furthermore, an intentional space can be made within a classroom and a curriculum.

Before an annual teachers' meeting in 2020 at a small private liberal arts university in Japan during the early days of the COVID Pandemic, a survey was given asking teachers to respond to various working hard and working smart statements. In short, the statements were collected from Terry Heick's list of ways to teach smarter (Heick, 2017).

The discussion results that ensued over Zoom and other meetings suggest that a more informed and deliberate approach to foreign language instruction within a university context is needed. The highlights include the following.

Share Ideas: With shared knowledge, achieving more becomes a more precise focus. When such sharing happens within the same program, students in different classes figure out there are new expectations before them.

Create Intentional Space: When students see the meaning and value of English, they will follow up by creating their own intentional spaces for English learning and acquisition.

That students develop a love for English is ideal. However, seeing as how all students are non-English majors, with a must-pass grade of 60%. If they love it, all the better.

Reflection is more important than following a plan. Plans always need adjusting to meet learner needs as the teacher reacts to the learners' development. An awareness of a bricolage approach to the eclectic nature of learning applies.

Learn more from different models. Embracing the bricolage continues with the mixing up of learning models. Keeping the students engaged requires more than one teaching method.

In short, teachers need to share ideas to create intentional spaces for students to learn. With an informed hope that they may love English, the classroom space and overall curriculum design need to foster the creation of intentional spaces. Reflecting on what worked is just as important as making plans. And the more informed teachers are, the better, as this applies to practical models for teaching. It is here where teachers are "teaching smart." These five topics ranked highest in the Heick survey on how to teach smarter. These top five formed the Most Advanced Yet Acceptable or "MAYA" Items from this survey.

Within the balance of Working Hard and Teaching Smart, all of these categories can assist teachers in extending their teaching reach and knowing when they have done enough. The teacher must understand that it is finally up to the learners to appropriate what is before them. Knowing when to say when will help teachers maintain a clear head, stay focused on the present tasks before them, and reinforce their initial sense of calling that led them to the teaching profession in the first place.

As for the other items, the teachers did not rank highly. Most were perceived as common sense, skills already acquired, or ideas that could not be readopted or changed due to school policy. Sampling follows in descending order of importance: prioritize work, take work home, use Moodle and Zoom, grade everything, less is more, say no, embrace mistakes, collaborate with others, emotion, and use social media.

Teaching smart came to mean: developing the necessary skills for online teaching, listening to teacher needs, and listening to student needs.

Later, after the first semester, full-time teachers who benefited from at least six years of experience working with the learning management system Moodle showed unique approaches to teaching online during the pandemic. Given the diversity of the entire staff, age, familiarity with technology, and teaching style, it was decided to offer a variety of ways for teachers to conduct classes remotely. Two categories were conduction classes: 1) via Zoom and 2) on demand.

3. Application - the flipped classroom

With the advent of the COVID Pandemic and the start of a new academic year, entirely online, full-time, and part-time teachers needed to consider the flipped classroom (Koblin, 2021). Even before the first semester began, there was pushback. One full-time professor, someone with a literature background and little or no computer skills, insisted on teaching on-demand without using Zoom. The argument was that if students receive assignments through the post office, and return their work in a set manner for grading and feedback, shouldn't that be acceptable. Realizing that the said instructor honestly could not do much more with Moodle than work with it as a convenient post office, permission was granted to create an intentional space within such parameters.

The members of the teaching team were not teaching in isolation. Each teacher had a partner teacher with a clear division of the teaching load. Preparation and Review quizzes were provided in Quiz Centers, also known as Metacourses in Moodle. Teachers were given links to publisher-provided worksheets in pdf form and "Moodleized" versions in quiz format in each locally assigned Moodle class. In theory and practice, no one teacher needed to create content to teach. There was plenty of content already provided. All they had to do was to conduct classes online or set up on-demand teaching plans.

3.1 The problem of inadequate space

Sadly, online teaching was quickly redefined to accommodate students' insistence that they have a right not to use their cameras and control their microphones. Mostly, they were in their bedrooms, where they did not want to show their private space or family living rooms.

This request was honoured but did not change the course purpose and overview: to build foundational English communication skills useful in the real world. Although the main focus is on oral communication, importance is also placed on vocabulary building, grammar, reading, and listening comprehension. The course design included the following learning cycle: Individual preparation (including e-learning), In-class practice, and Individual review (including e-learning). The aim is to establish communication skills in English and see students shift from passive learners to active participants ("2020 CEP Teachers' Handbook," 2020). Additionally, evaluation is based on Preparation and Review quizzes, in-class performance, mini-quizzes, assignments, midterms, and final exams. Only the Preparation and Review quizzes are preset. All other adjuncts can be accessed from the available stock in either the teacher's assigned Local Class or the relevant Quiz Centers.

3.2 Creative ways to adapt

While keeping the course goals in mind and honoring student requests for a no-camera environment, teachers needed to adapt or find ways to teach and follow the course syllabus. Given the diversity of teacher backgrounds, familiarity, and lack thereof with online teaching and management of Moodle, teachers branched out to fill in where they perceived voids, both old and new. An old void could be a class full of passive learners, while a new void would be fostering a communicative classroom but online. Visible is the bricolage environment as seen by four different teachers. The following examples show how a teacher(s) increased the number of quizzes to include material directly from the textbooks to benefit those few who could not participate in a live Zoom class. In contrast, other teachers assumed that if a few could not join in Zoom, then structure the class to give

assignments via PDF uploads. Quizzes were not used beyond the ones already provided. How each teacher applied themselves in light of the new challenges illustrates how the MAYA principle was evident. Teachers selected what was best, or rather, most advanced and acceptable to use. The following charts show how four teachers negotiated to teach online or on-demand during the first semester of the COVID Pandemic. The four teachers reflect the "bricolage-like" diversity: a Japanese national with a literature background; a native speaker with no teacher training or certification; a Japanese national with a Master's in Education and ten years of teaching high school English; and a native speaker with a Masters in English Education and extensive background in computer-assisted language learning. All teachers had sufficient computer skills to accomplish what they desired for student benefit within the online Zoom / Moodle environment and could determine how much or how little they would do.

3.2.1 PDFs

Moodle offers the use of PDFs to distribute information, instructions, and tasks. PDFs on Moodle are not interactive and a regarded as resources. For the teacher, they are fast and easy to upload. How students respond is determined by the teacher.

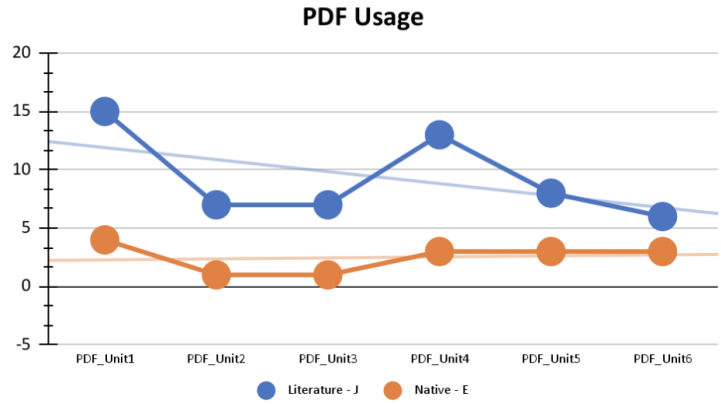

Figure 1: Usage of PDFs within Moodle local class as a teaching resource

Of the four teachers, two used the PDFs over the semester. One teacher had a literature background, while the other was a native speaker of English with no particular training in TEFL.

3.2.2 Assignment activity

Moodle offers the use of the Assignment to collect and evaluate student work. Managing student work using an Assignment activity provides a convenient database of student submissions that can be managed online ("An Overview of Assignments in Moodle," 2022). For the teacher, they are fast and easy to upload. Students respond by a deadline set by the teacher. One drawback is that assessing each submission can be a labor-intensive task.

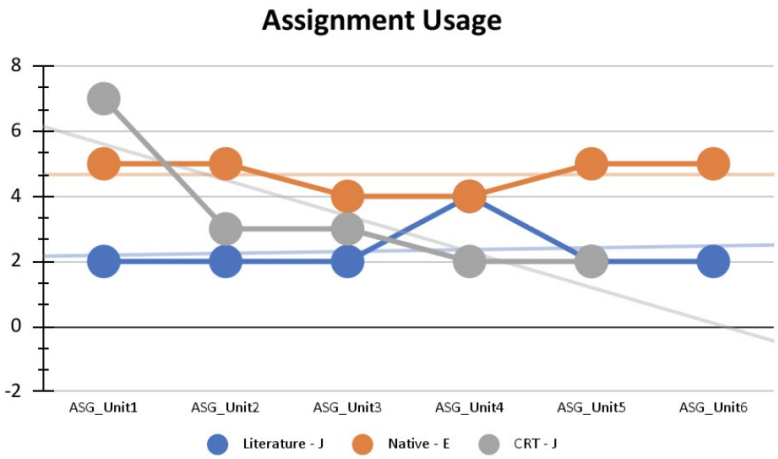

Figure 2: Usage of assignments within Moodle local class as a teaching activity

Use of the Assignment was used by three teachers: the literature, native speaker of English, and licensed teacher. The trend lines indicate that only teachers with a teaching license (CRT - J) decreased its use over time. Only the CRT - J graded all submissions. The others did not use the Assignment for reasons that remain unclear.

3.2.3 Quiz module

Moodle offers the use of quizzes to evaluate students' understanding. Moodle quizzes consist of a Quiz activity that contains one or more questions from a Question Bank. The Quiz activity allows the teacher to administer a wide range of questions within a specific layout and order, provide different kinds of feedback based on how a student performs on the quiz, and control the ways students can access the quiz ("An Overview of Quizzes in Moodle," 2022).

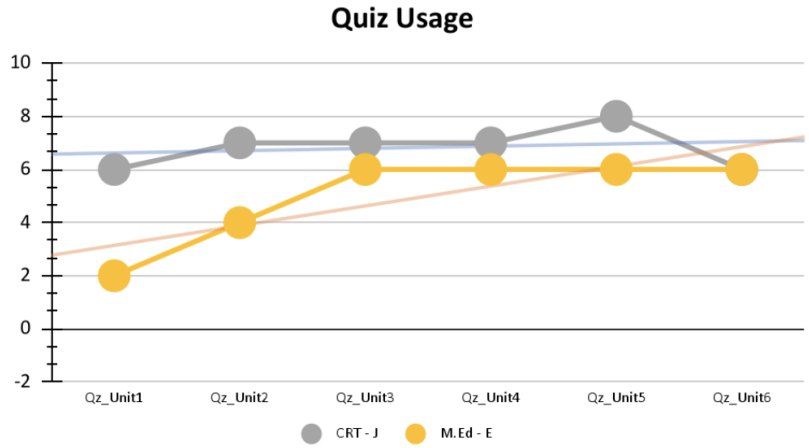

Figure 3: Usage of quizzes within Moodle local class as a teaching activity

The instructors with either teacher certification or a Masters in Education made increasing and consistent use of the Moodle Quiz activity. The others preferred to distribute PDFs or give Assignments. Grading assignments online did not happen.

4. Discussion

Given that the course syllabus clearly defined goals, gaps occurred when implementing online teaching and Moodle. Seeing the aggregate use of Moodle resources and activities, gaps are conspicuous.

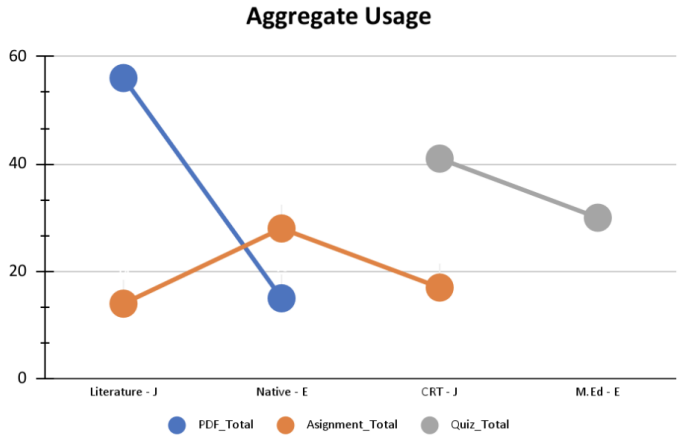

Figure 4: Aggregate Look at preferred use of resources and activities.

Moodle is a connector. As Penny Ur has said: a gap fill is a gap fill (Nováková, 2013). This comment could infer that she had little use for computer-assisted language learning. However, that would be too simplistic. For example, an online gap fill can provide metadata that would otherwise be inaccessible if one were operating strictly within an analog environment. Moreover, gap-fills, assignments, quizzes, and other ancillary tasks build confidence for communication when the learners have not received instruction.

Relying only on resources diminishes the learning experience and widens the gaps, exacerbating the bricolage environment, only demonstrating that some tools within Moodle were too advanced to be acceptable. The creation of intentional space collapses at the program level.

5. Conclusion

If intentional space at the EFL program level is to be created, gaps and voids filled with more teachers in compliance with MAYA for branching out of their bricolage diversity and teaching tools, such as Moodle. Simply putting teachers in front of a computer, and showing them what can be done, is not enough. Teachers need to be led with mini-tasks to create that "WOW!" moment, as Ur referred to at JALT2013 (Darren Elliott, 2017). If such never happens, EFL programs will likely continue to fall short of their high-sounding goals, with teachers being in violation of MAYA and the creation of intentional space limited.

References

2020 CEP Teachers' Handbook, 2020.

An Overview of Assignments in Moodle [WWW Document], 2022. URL https://www.umass.edu/it/support/moodle/overview-assignments-moodle (accessed 5.5.22).

An Overview of Quizzes in Moodle [WWW Document], 2022. URL https://www.umass.edu/it/support/moodle/overview-quizzes-moodle (accessed 5.5.22).

Bauwens, M., 2008. The art of creating intentional spaces. P2P Found. URL https://blog.p2pfoundation.net/the-art-of-creating-intentional-spaces/2008/11/09 (accessed 1.27.20).

CMG Worldwide, 2020. Biography - The Official Licensing Website of Raymond Loewy. URL http://www.raymondloewy.com/about/biography/ (accessed 1.10.22).

Darren Elliott, 2017. An Interview with Penny Ur.

Design - Raymond Loewy, the first real Mad Man, 2017. Des. - Raymond Loewy First Real Mad Man. URL https://earlofcruise.blogspot.com/2017/10/design-raymond-loewy-first-real-mad-man.html (accessed 10.31.20).

Goetz, T., 2018. Readiness quizzes as adjuncts for ensuring gateway class success. Hokusei Gakuen Univ. Res. Soc. Welf. Bull. 56, 127–136.

Goetz, T., 2012. Extending your reach with Moodle materials [WWW Document]. Google Docs. URL https://docs.google.com/presentation/d/1QMWYDkhs8lU9BHDHE8u_MZ3XvCv2Yjg74JnglTZLle8/edit?usp=drive_web&ouid=114648689646431047788&usp=embed_facebook (accessed 5.6.22).

Heick, T., 2017. How To Work Smarter--Not Harder--As A Teacher. TeachThought. URL https://www.teachthought.com/pedagogy/work-smarter-not-harder-teacher/ (accessed 1.27.20).

Koblin, J., 2021. The Flipped Classroom Model – Sprouts — Free Videos for Schools and Learning. URL https://sproutsschools.com/the-flipped-classroom-model/ (accessed 5.4.22).

Lise, A., 2013. Metaphors for engaging with bricolage, in: R.Ed Research in Education. pp. 8–10.

Nováková, T., 2013. Teachers don't just teach; they learn. | Scelt. URL https://scelt.sk/teachers-dont-just-teach-they-learn/ (accessed 5.5.22).

Pringle, H., Field, P., 2009. Brand Immortality: How Brands Can Live Long and Prosper:

Redfield, M. "Rube," 1990. Japanese University Hiring Practices and the Masters in TEFL. Cross Currents 17, 89–91.

Seale, A., 2017. Creating Intentional Spaces, Empowering Awareness To Action - The Center for Transformational Presence Looks Ahead. Cent. Transform. Presence. URL https://transformationalpresence.org/alan-seale-blog/creating-intentional-spaces-empowering-awareness-action-center-transformational-presence-looks-ahead/ (accessed 1.27.20).

Turkle, S., Papert, S., 2016. Epistemological Pluralism and the Revaluation of the Concrete 26.

Yoshida, A., 2019. From Education to Learning Outcomes: How Can Academia Show the Evidence to Stakeholders? High. Educ. Forum 16, 1–13.

Adapting OER: Addressing the Challenges of Reuse When Designing for HE Capacity Development

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Abstract: Changes in learning and teaching due to COVID-19 have prompted higher education (HE) institutions to develop strategies and skills related to technology-supported education, creating development opportunities that help staff teach and support students in online or blended situations. Using open educational resources (OER) meant training could be developed and localised quickly. However, there has been little research into the use of OER to meet urgent, unanticipated teaching needs. This paper provides a critical reflective account of learning design for the use of OER in a national capacity development initiative in Kenya as part of the Foreign, Commonwealth and Development Office (FCDO) funded Skills for Prosperity Kenya project. Development of this OER was led by The Open University in partnership with 37 Kenyan universities. The initiative was designed to develop the knowledge and skills of educators, educational leaders, and support staff. The contribution of this paper is that it identifies challenges encountered when adapting OER for use in a technologically low-resourced context, showing how these can be addressed successfully at different learning design stages. Challenges were identified using the 7Cs of Learning Design (Conole, 2014): conceptualise, create, communicate, collaborate, consider, combine and consolidate. The paper concludes with recommendations for design practice and creating and remixing OER.

Keywords: learning design, capacity building, CPD, OER, online learning, accessibility

1. Introduction

COVID-19 forced educational institutions worldwide to move from face-to-face to online teaching within days or weeks. Many institutions had neither the skills nor the resources to change their pedagogic approaches to follow best practices developed and trialled in online educational settings over the past three decades. As remote education became the norm, 'a central challenge concerned sustaining educational visions and ideals in such circumstances' (Stracke et al, 2022: p1). There was an urgent need for contextually relevant professional training for educators that could be accessed at a distance.

Good quality professional development takes time to develop but OER offered the opportunity to access relevant content, including resources developed by expert researchers and practitioners. OER are "teaching, learning, and research materials that are either (a) in the public domain or (b) licensed in a manner that provides everyone with free and perpetual permission to engage in the 5R activities of Retain, Reuse, Revise, Remix and Redistribute" (Creative Common, 2010). However, although high quality OER relating to moving teaching online were available, there are challenges associated with locating appropriate materials and adapting them to their new context(s). Moreover, as Amiel (2014) notes "Remix is touted as one of the most important practices within the field of open educational resources (OER). But remixing is still not mainstream practice in education and the barriers and limitations to remix are not well known."

Amiel (2014) discusses the development of an OER to support Brazilian teachers in their use of OER. Challenges included: licence type compatibility, translation, dominance of English language resources and bias, understanding learner and educator contexts, and ensuring the final remixed OER enables further use and remix.

In an analysis of the TESSA and TESS-India teacher education projects, Buckler et al (2014) describe challenges encountered during the collaborative remix process. These included the duration and nature of the localising process; "cultural differences" including familiarity with this type of collaboration and critique of others' work; and the project's restricted approach to remixing OER. They highlighted dominance of Global North, and specifically English-language resources, particularly in relation to one-way, non-reciprocal sharing of OER and

"neo-colonial practices". As the current paper highlights, the process of localisation and meaningful collaboration is critical.

Ivins' (2011) study of OER reuse in Nepal identified a range of logistical and technical considerations and barriers. Localisation as "making knowledge more useful and relevant for local needs" (Ivins, 2011, p.118) requires "customizing content to reflect local resources" (Ibid); appropriate use of language, particularly in contexts with many dialects and languages within one country; "embedding content within a local cultural framework" (p.122), and "incorporating gender sensitive messages" (p.123). This requires an understanding of the context, appreciation of regional differences, identification of and seeking solutions to "shared problems" to promote cohesion (p.126) and ensuring that materials reflect strength in diversity/differences and similarities. Like Buckler et al (2014), Ivins noted reluctance to make changes to existing materials due to perceptions of 'expertise'.

When developing teaching or training, challenges can be identified and addressed at the learning design stage. This is particularly important with online learning, as courses are often developed at scale, with input from subject-matter experts concentrated at the development stage. Unlike synchronous face-to-face teaching, where the design can be adjusted while the course is running, changing an asynchronous online course in progress is difficult as some students may already have completed the section being changed.

Among the many models of learning design (Dalziel et al, 2016), one of the best known is the 7Cs of Learning Design (Conole, 2014; Conole, 2018). This supports educators' design decisions from initial conceptualisation of learning to final evaluation, while supporting replication of learning and teaching experiences. As the name suggests, there are seven elements to this approach: conceptualise, create, communicate, collaborate, consider, combine and consolidate. These can be divided into three activity periods: before, during and after the course run.

Before the course, educators define what, why and who the course is designed for and decide its principles and pedagogical approach (Conceptualise). While the course is running, students are supported to engage in activities that provide opportunities for learning; creating new materials or repurposing existing ones (Create), communicating and interacting (Communication), working together (Collaborate); and then reflecting and working on assessment tasks (Consider). As the course ends, learning designers and educators can reflect on the success of the design and how it could be modified, taking into account factors such as time required for tasks, activity types, and timeline of different activities (Combine). Finally, course effectiveness is evaluated, and changes are made (Consolidate).

2. Methodology

The 7Cs approach provides a structure for identifying and addressing challenges at each step of the learning design process and can also be used to structure reflection. In order to answer our research question, 'What are the challenges involved in adapting OER for use on a nationwide professional development course and how can these be addressed?', we used the 7Cs Framework to structure a critical reflection.

This study focuses on the learning design of an online capacity development course in digital education for staff in all Kenyan public universities. *Digital Education for Universities in Kenya (DEUinK)* forms part of the Skills for Prosperity Kenya programme. It introduces HE staff to principles of effective, inclusive and accessible online education, strengthening their skills and capabilities for delivering online university education.

The Kenyan HE sector lacked sufficient expertise to design and deliver digital education (Neyrey, 2020; Tarus et al, 2015), a challenge identified in the country's National Education Sector Strategic Plan 2018-22. The government (Kenya Vision 2030) therefore prioritises enhancement and development of digital education as a key route to improving access to HE nationwide and providing socio-economic benefits to learners (Kibuku et al, 2020). DEUinK was developed to close the gap in required expertise.

In order to address the research question, the three educators who designed the course reflected critically on each stage of the learning design, focusing on the use of OER. Sources of data for this critical reflection were: individual accounts; learning design documents including course outline, meeting notes, and reflective email conversations; the course; course engagement; post-course survey responses; and learner activity following

completion. Individual narratives and personal experiences of the three lead educators were used to strengthen the overall account.

3. OER

DEUinK used a wide variety of OER, developed around the world. Two were fundamental to its structure. The first was 'Take Your Teaching Online', a badged open course from The Open University (UK), hosted on the OpenLearn platform, and available as CC BY-NC-SA 4.0, a Creative Commons licence. This OER course covers understanding digital tools, selecting technologies, developing support networks, accessibility in online teaching, and evaluating change.

In addition, JISC's (2015; 2019a; 2019b; 2019c; 2019d) Digital Capabilities Framework for the roles of teachers, leaders and professional services was used to identify gaps in digital skills and knowledge and set the learning outcomes for DEUinK. This framework was developed with a range of stakeholders using a co-design approach to identify challenges faced by institutions when developing digital capabilities of staff and students. It describes the skills needed by those in academic, administrative and professional roles to thrive in a digital environment. This framework includes life-long learning, scholarship and self-development, which are neglected by other frameworks (Biggins et al, 2016).

4. Learning design process

DEUinK requires 24 hours of study and shares 'the fundamental knowledge needed to deliver effective teaching online'. This section outlines the challenges associated with the 7Cs of the course and discusses design, production, accessibility and inclusion considerations taken into account when addressing these.

Table 1: Challenges of Adapting OER for DEUinK

Challenges of adapting OER for an online nationwide capacity development programme	
Meeting national needs	Retention and completion
Adapting to local context (Kenya)	Technical support
Variation in local context	Low resources (e.g., internet connection)
Individual learner needs	Staffing levels
Learner agency	Inclusivity
Constraints on learners (e.g. time, workload)	Accessibility
Range of learner roles	COVID-19 conditions
Learner unfamiliarity with online learning	Creation of new OER where appropriate
Appropriate pedagogical approach	Consultation and forward planning
Assessment and recognition of learning	OER sustainability

4.1 Conceptualise and create

The course introduced principles of effective online education to HE staff, strengthening their digital skills and capabilities. It also provided a good example of accessible and inclusive online learning experience for participants to replicate. To do this, learning design and course pedagogy had to meet national and local needs; be responsive to individual learner needs; consider a range of learner levels and roles including educators, managers and support staff; learners' unfamiliarity with online learning; constraints on learners (e.g. time); limited resources (broadband, devices used); and conditions caused by COVID-19. In addition, challenges related to learner motivation, retention and recognition of their achievements had to be taken into account while ensuring appropriate technical and learning support were available. Course sustainability and forward planning were further considerations.

The Open University's "supported open learning" pedagogical model was used to address many of these challenges. This model is flexible (learners work where and when they choose to fit in with their professional and personal commitments), inclusive (needs of different learners are accommodated) and social (learners have opportunities to communicate and meet). It emphasises learning support (staff provide academic expertise, support and guidance) (McAndrew and Weller, 2005). This was consistent with the chosen OER's pedagogy and avoided confusing learners by using multiple pedagogies, which often occurs when OER are remixed and repurposed.

To attend to national, local and role-related needs, a needs assessment based on the JISC Digital Capabilities Frameworks was conducted. This identified digital needs and skills gaps, learning preferences and context (connectivity, device), and individual differences including type and level of any disabilities. This helped when setting course aims, identifying learning outcomes and support requirements. Course learning outcomes were mapped to OER learning outcomes to identify gaps in content and areas that were not relevant to the training. Learning outcomes were revised based on three groups of learners: educators, managers and support staff. Content was produced for topics not covered by the OER, course activities relevant to all learner groups were created, assessment (multiple-choice questions were used for formative and summative assessment) was aligned with the new learning outcomes, and the course balanced four activity types: assimilative, reflective, productive, finding and handling information. A local representative in Kenya supported this process by providing insights into local and regional needs and professional learning culture. This supported the enriching and contextualisation of the learning design, localising and revising OER content by directing us towards replacing (and where necessary co-creating bespoke) OER images to represent Kenyan culture, and educational context in a gender-balanced manner, using local examples and sometimes terminologies, ensuring different ethnicities are represented as much as possible, and removing culturally taboo references. Since English is one of Kenya's official languages, the translation of OER was not required and saved us production time and costs.

The course ran during the pandemic when most learners were in full-time employment. Five delivery considerations were therefore critical: flexible scheduling, retention challenges, Internet access, learners' limited experience of online study, and inclusion / accessibility. The course had to be delivered online, offering flexibility with minimum demand on staff time. An asynchronous self-paced delivery mode was chosen. The flexible scheduling enabled learners to engage at their own pace, fitting study around their work and family commitments. This flexibility was also valuable for learners with disabilities such as dyslexia or long Covid that can make concentrating and remembering information difficult.

The disruption caused by the pandemic to personal and professional lives meant there was a risk learners would be unable to complete the course. ICEBERG design principles for retention (van Ameijde et al, 2016) including integrated, balanced, reflective and gradual curriculum design were therefore applied. In addition, a distributed award system of digital badges and a certificate was developed to encourage participation and completion. Badges were awarded for successful completion of the first and second halves of the course, and everyone who completed the course also received a certificate.

The pandemic meant most university staff in Kenya were working off-campus. This had connectivity and access implications (i.e. limited or unreliable internet). The course was therefore available in multiple formats that could be downloaded. This allowed learners to download learning resources when they had Internet access and then work on them offline.

Most learners did not have experience of online or distance learning; so an introduction to online learning was created, supporting staff to study the course and prompting them to reflect on what their students would need to know in order to become effective online learners.

Accessibility and inclusion strategies included provision of technical support and guidance through an accessible learning platform, downloadable learning content, an online community of practice and a technical team. Learning content and activities were designed to meet international accessibility standards, all images and diagrams were accompanied by alternative text for screen readers, and all videos had transcripts. Transcripts accommodated not only the needs of some learners with disabilities but also the needs of learners who did not have the bandwidth to view a video but were able to download a transcript. In addition, when revising the content, local images and examples were used, clip-arts were repurposed, and examples of inclusive practice were provided.

Flexible scheduling enabled learners to engage at their own pace. The option to study in short bursts and return to challenging material provided the time necessary to process and engage with content. However, although most of the measures taken to support learners were successful, when the course ran, this flexibility affected peer interactions and the course community activities negatively.

4.2 Communicate

Aspects of challenges related to inclusivity, staffing levels, technical support requirements and course sustainability as well as constraints on learners (e.g. limited time) were addressed by creating opportunities for different types of communication. The course design used learner-content interaction to enable flexible scheduling. To ensure deep and meaningful interaction with content, reflective activities relating to learners' roles and practices were built in. Additionally, learners were encouraged to engage in peer interaction through communicative activities that used the course online community of practice (a Facebook group). This was a space that enabled learners to interact with the educators and the technical team for support; network and provide / receive peer support and develop a digital education national community.

When the course was implemented, the online community was successfully used for social and resource sharing purposes. However, there was little discussion of course activities, perhaps because the self-paced nature of the course meant learners worked on activities at different times.

4.3 Collaborate

To meet the Kenyan government's national training requirements (a compact course designed for self-study), as well as adapting to the local context by considering the different composition of teams of learners from each university, collaboration opportunities were not built into the course. In most cases, learners did not know each other, were based in different departments and had different roles. As a result, pedagogies that involved collaboration were not considered suitable for the context, and OER that required collaborative work were either set aside or adapted for individual use.

4.4 Consider

This stage of learning design, which focuses on assessing learning, addressed challenges including staffing levels, learning conditions caused by COVID-19 and recognition of achievements while supporting forward planning.

Following the course's supported pedagogical approach, a continuous assessment strategy was used to help learners check and regulate their learning while helping course authors identify areas to be revisited. Each session included a quiz with a variety of question types aligned with the learning outcomes. Automated feedback to incorrect responses prompted learners to revisit relevant content and activities. Quizzes thus played formative and summative roles, providing immediate feedback without requiring synchronous staff engagement. The course platform, itself an OER, would normally require learners to achieve a certain score on summative quizzes and to visit every course page. However, as some learners studied offline due to connectivity issues, the assessment was adjusted and the requirement to visit every page was removed.

University staff found that taking time to complete the course was difficult because they were not only learning the skills necessary to teach online, but the pandemic also forced them to apply these skills immediately. The distributed award system, described in 4.1., was developed to support motivation and retention.

4.5 Combine

As the course ran, the course authors reflected on the learning design and necessary modifications. The course map (which identified each session's learning outcomes, their links to JISC digital categories, details of learning resources, activity types and time, wordcount and related reading time) was examined to audit the course outline, check the sequencing of sessions and the learning path, ensuring activity types and times were spread reasonably across sessions. This helped with forward planning while ensuring the course was relevant to different learner roles, constraints on learners were adequately addressed, and the course supported non-linear learning paths. In particular, many OER relating to online teaching are addressed to teachers. However, many course learners had other responsibilities in relation to online teaching – they included managers in charge of the curriculum, ICT officers, and those providing technical or pastoral support to students (see Figure 1). The course included 254 HE staff (64% male, 36% female) nominated by their universities (i.e. 29 public HEIs) for the training. Nearly half of learners (48%) were educators; however, the rest were ICT officers (17%), staff in a managing role (15%), heads of departments (6%), deans (3%), and staff from academic and support

services. Figure 2 displays the breakdown of learners based on their department. This meant OER had to be adjusted to take these different perspectives into account.

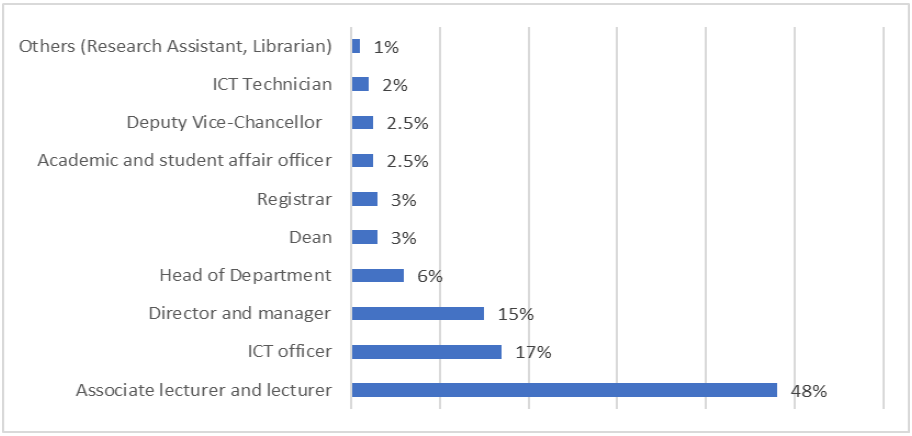

Figure 1: Learner roles involved in DEUinK

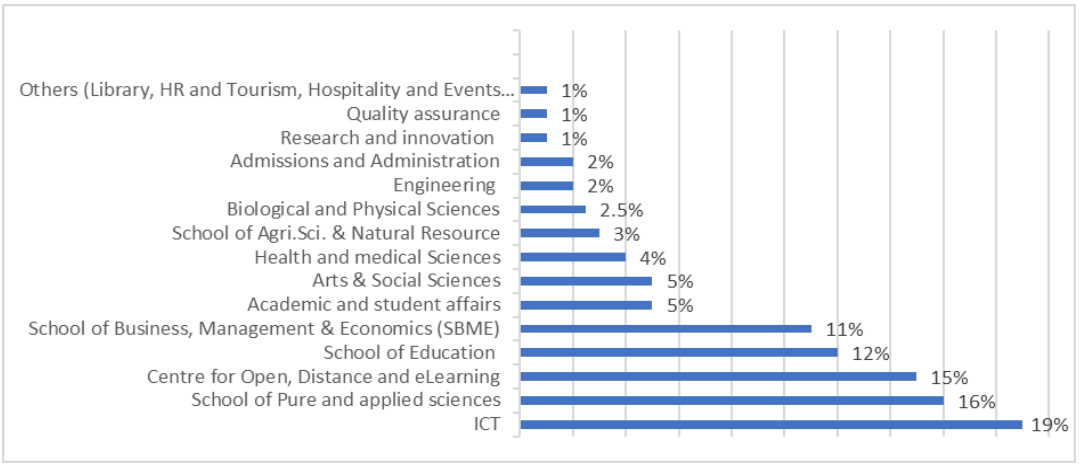

Figure 2: Participating departments in DEUinK

Another aspect to review was guidance and support for learners. A session about online study skills was created as an OER to help learners develop these skills. However, many learners skipped this session, which led to demands for individual support. In future, this session will also be available as a webinar. Technical support was delivered through FAQ, a course technical team; and discussion in the course online community. The technical team also supported disabled learners on a one-to-one basis. An in-country co-ordinator dealt with inquiries that could not be addressed at a distance. Technical support requirements, local needs and staffing were thus dealt with using a combination of OER and staff support.

To support retention and minimise dropouts, in addition to the distributed award system, a two-week break for catching-up and processing information was built into the course. Live events were included at the beginning, middle and end of the course. These provided an induction to the course, a mid-point progress check and support, and a course conclusion and celebration of achievements. The online community of practice was the main mechanism for peer and educator support and meant that learners could receive individual support even though staffing levels on the course were low. These strategies resulted in 70% of enrolled learners (n=177) engaged with at least half of the course and received their first badges and 65% (n=165) completed the training and were awarded a second badge and certificate. As shown in Table 2, the strategies supported learners in several roles. Deans, ICT technicians, academic and student officers and Deputy Vice-Chancellors engaged fully with the course. However, fewer lecturers, ICT officers, Heads of Departments and registrars moved beyond the first half of the course. Although this drop in most cases is not considerable.

Table 2: DEUinK badge award based on role

	Lecturer & AL	ICT Officer	Director & manager	Head of Department	Registrar	Dean	ICT Technician	Academic & Student Officers	DVC	Librarian
No. of Badge 1	78	34	30	9	7	5	5	4	4	1
No. of Badge 2	77	30	25	8	6	5	5	4	4	0

A final aspect to examine was the creation of new OER, where appropriate, and course suitability. The course is licensed under Creative Commons and will be openly available after the funded period. This will extend course availability for those who do not complete it within the project lifetime, increase the reach of the course, and enable reuse of OER (Ivins, 2011).

4.6 Consolidate

The experience of adapting OER and re-presenting it demonstrated that different learning design elements can work effectively if challenges are addressed before and during course delivery, and options for future reuse and repurposing are taken into account. The course met national, local and individual needs through a supported pedagogy that emphasised accessibility and inclusivity and attended to constraints on learners. This is evident from the first set of post-course survey responses (n=121). They showed that 98% of learners agreed or strongly agreed that the course met their needs and helped them:

- learn more about online education
- acquire knowledge and skill that is relevant to their job
- incorporate new practices related to online education/ services into their practice

The post-course survey as a way of developing learner agency and involving them in the adaptation process also showed that the course pedagogy, together with course flexibility, mostly supported learning and retention, since 73% of learners reported no challenges in engaging with and completing the course. In addition, more than half of (54%) participants who declared a disability completed the course. However, as educators we identified a number of challenges to be addressed in future iterations. The flexibility of the course meant learners could complete it at their own pace, but this limited opportunities to engage with the online community of practice. Although this was used as a space for peer interactions and communications with the course team, it did not foster much discussion around course activities. It was used mainly for social support and resource sharing purposes, fostering social presence. A second challenge was that attending to national and local needs limited opportunities for collaborative and practical activities, which was identified as a weakness by some learners. In future iterations of the course this could be addressed by including such activities but making them optional and learner directed. To meet national needs, the needs assessment, desk-research and support of a local representative were important; however, deeper insight into professional learning culture and expectations would allow the OER to be further tailored as an online professional development programme. A final challenge was that the creation of new OER to develop learners' online study skills did not work in all cases as some learners skipped the relevant session. In future, offering a webinar alternative to the online study skills training would address the professional learning preferences of more learners.

5. Implications and conclusions

This paper has provided a critical reflection on the challenges associated with adapting and re-presenting OER for a nationwide online professional development and capacity building of HE staff in a low-resourced context and has outlined ways to address these challenges. The reworked OER had to meet national, local and individual needs; be adapted to local context; present a consistent pedagogy; be accessible to all staff, including those with disabilities; include not only teachers but all staff responsible for the design and delivery of online courses; take into account low levels of resource, particularly restricted internet access; acknowledge constraints on learners such as workload and limited time; run successfully with low staffing levels; address learner unfamiliarity with distance and online learning; include measures to encourage retention and completion; recognise and celebrate learners' achievements; offer technical support requirements; create new

OER; and plan for future use and sustainability of OER. All this in a global context where the activities of everyone involved were restricted by the COVID-19 pandemic.

Before adapting the OER, desk research together with a needs assessment and insights provided by local stakeholders supported the identification of gaps and helped to set learning outcomes and priorities. In addition, they highlighted areas of contextualisation such as enriching material on accessibility and inclusion, changes to visual material such as images to ensure balance in gender and ethnicity representation and relevance of material to local and national needs for the design and delivery stages. This in turn, led to choosing an appropriate pedagogical approach compatible with the pedagogies of the original OER that minimised confused pedagogy.

At the design stage, accessibility and inclusion strategies were important considerations. Accessible design and delivery included accessible learning materials and activities; flexible scheduling and a distributed award system; technical support and guidance through an accessible learning platform (itself an OER); downloadable learning content and technical support. These strategies helped address challenges ranging from individual learner needs, through limited resources and constraints on learners, to difficulties caused by COVID-19. Decisions in these areas were supported by a continuous assessment strategy and a distributed award system to maximise learner motivation, retention and course participation and an online community of practice for peer and educator support and communications. While delivering the course, the learning support was extended by offering wraparound webinars, an online community of practice, and responses from the local representative to issues that were not resolvable at distance. After the course end, the post-course survey and learners' reflections supported forward planning and strategies for sustainability of the created course and expanding its reach.

Kenyan universities are now developing training based on the DEUinK to extend its use beyond the project. DEUinK will be available as an OER after the funding period and will enable universities in both Kenya and other countries to reuse and remix this OER to develop staff capacity.

References

Amiel, T. (2013) "Identifying barriers to the remix of translated open educational resources", *The International Review of Research in Open and Distributed Learning*, Vol. 14, No. 1, pp 126-144. https://doi.org/10.19173/irrodl.v14i1.1351

Biggins, D., Holley, D., Evangelinos, G., and Zezulkova, M. (2017) "Digital competence and capability frameworks in the context of learning, self-development and HE pedagogy". In Vincenti, G., Bucciero, A., Helfert, M. and Glowatz, M. (Eds). *E-learning, e-education, and online training* (pp. 46-53). Springer, Cham. DOI 10.1007/978-3-319-49625-2

Buckler, A., Perryman, L-A., Seal, T. and Musafir, S. (2014) "The role of OER localisation in building a knowledge partnership for development: The TESSA and TESS-India teacher education projects". In: *OCWC Global Conference,* [online], http://oro.open.ac.uk/40348/ , Ljubljana, Slovenia, April.

Conole, G. (2014) "The 7Cs of Learning Design – a new approach to rethinking design practice". In Bayne, S., Jones, C., de Laat, M., Ryberg, T. and Sinclair, C. *Proceedings of the 9th International Conference on Networked Learning 2014*. [online], https://www.lancaster.ac.uk/fss/organisations/netlc/past/nlc2014/abstracts/pdf/conole.pdf, Edinburgh, UK.

Conole, G., (2018) "Developing digital literacies through continuing professional development", *Educația Plus*, Vol 19, No. 1, pp.21-30.

Creative Common. (2010) "Open Education", [online], https://creativecommons.org/about/program-areas/education-oer/ .

Dalziel, J., Conole, G., Wills, S., Walker, S., Bennett, S., Dobozy, E., Cameron, L., Badilescu-Buga, E. and Bower, M. (2016) "The Larnaca Declaration on Learning Design", *Journal of Interactive Media in Education*, No 1, p 7. DOI: http://doi.org/10.5334/jime.407.

Ivins, T. Z. (2011) "Localization of Open Educational Resources (OER) in Nepal: Strategies of Himalayan Knowledge-Workers", PhD Dissertation, Brigham Young University, [online] https://eric.ed.gov/?id=ED528009

JISC. (2015) "Digital Capabilities Framework", [online], https://www.jisc.ac.uk/rd/projects/building-digital-capability.

JISC. (2019a) "Digital Leader Profile", [online], *available at* https://repository.jisc.ac.uk/7351/1/BDCP-DL-Profile-230419.pdf .

Jisc. (2019b) "Learning Technology Mapping"', [online], https://repository.jisc.ac.uk/7280/1/BDCP-LTMapping-110319.pdf .

Jisc. (2019c) "Library and Information Professional Profile", [online], https://repository.jisc.ac.uk/7281/2/BDCP-LIP-Profile-110319.pdf.

Jisc. (2019d) "Professional Services Staff in Education Profile", [online], https://repository.jisc.ac.uk/7389/1/BDCP-PSS-Profile-300419.pdf.

Kibuku, R. N., Ochieng, D. O., and Wausi, A. N. (2020) "e-Learning Challenges Faced by Universities in Kenya: A Literature Review", *Electronic Journal of e-Learning*, Vol 18, No 2, pp 150-161.

McAndrew, P., Weller, M. (2005) Applying Learning Design to Supported Open Learning. In: Koper, R., Tattersall, C. (eds) *Learning Design*, Springer, Berlin, Heidelberg. https://doi.org/10.1007/3-540-27360-3_17 .

Nyerere, J. (2020) "Kenya's University Students and Lecturers Face Huge Challenges Moving Online" *Conversation*, [online], https://theconversation.com/kenyas-university-students-and-lecturers-face-huge-challenges-moving-online-136682.

Stracke CM, Burgos D, Santos-Hermosa G, et al (2022) "Responding to the initial challenge of the COVID-19 pandemic: Analysis of international responses and impact in school and higher education", *Sustainability.* Vol 14, No 3, pp 1876.

Tarus, J. K., Gichoya, D., and Muumbo, A. (2015) "Challenges of implementing e-learning in Kenya: A case of Kenyan public universities", *International review of research in open and distributed learning*, Vol 16, No 1, pp 120-141. https://doi.org/10.19173/irrodl.v16i1.1816

The Government of Kenya. (2007) "Kenya Vision 2030", [online], https://vision2030.go.ke/

"The National Education Sector Strategic Plan (NESSP) 2018-2022", (2018), [online], https://www.globalpartnership.org/content/kenya-national-education-sector-strategic-plan-2018-2022

Van Ameijde, J., Weller, M. and Cross, J. (2016) "Designing for student retention: The ICEBERG model and key design tips", [online], http://www.open.ac.uk/blogs/learning-design/wp-content/uploads/2020/09/ICEBERG-booklet-compressed.pdf

A Literature Study on Experiential Collaborative e-Learning Based on ECEL Articles

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Abstract: Educational institutions around the world continue to develop teaching practices in which the importance of digital solutions is expanding. The increasing digitization of education and learning has made it even more important to explore and test how experiential collaborative teaching methods can be digitized and designed to facilitate collaboration, active participation, and exploration, elements that are all crucial to support development of complex skills and competencies. Previous research reveals that many solutions for e-learning do not sufficiently support more complex forms of learning. The authors argue that many technologies developed for the field of education fall short of their purposes and neglect or ignore intended underpinning pedagogy and didactics. As new technologies are being developed, promising great improvements in supporting student' learning processes, the problem is exasperated by a technological euphoria, supported by EdTech companies, which effectively undermines appropriate cautions and reservations. The article applies the overarching conceptualization **Experiential and Collaborative learning (ECL)** in an attempt of include an array of established and complex educational methods or pedagogical models, such as Problem-Based Learning (PBL), Reflective Practice-based Learning (RPL) and Inquiry- of ECL have been derived. Based on those keywords, a systematic literature study within the database of ECEL article from 2012-2021 has been conducted to investigate and summarize the potential gap often seen between pedagogical and technological development in Edtech. The research question is twofold: "How is ECL addressed in ECELs papers" and "What is the potential gap transforming ECL to digital solutions"? The findings reveal that ECL is present in many articles to some extent. However, after sorting the articles using PRISMA, only a few articles are included capturing the complexity of ECLs. Based on the selected articles, gaps and potentials are identified, indicating a need for further research.

Keywords: experiential collaborative learning, ECL, technology, PRISMA

1. Introduction

Globally, educational institutions continue to develop teaching practices where digital solutions play an increasingly larger role (Albæk, 2018). While many educational institutions have been working for a long time in various ways to integrate open, experiential and collaborative learning designs into their practice, lockdowns, in particular as a result of the Covid-19 pandemic, and the resulting rapid transition to digital emergency education (Georgsen, 2021) have revealed, that many of the existing digital learning platforms do not adequately support the experiential, collaborative forms of learning. The increasing digitisation of education and learning has created a need to explore how experiential and collaborative teaching methods are being digitised so that collaboration, active participation, and exploration still support the learner in developing complex skills and competencies. According to Selwyn (2016), a technological euphoria created by EdTech companies contributes to undermining relevant caution. In addition, new technologies are constantly being developed, promising great potential in supporting and strengthening students' learning processes but educational institutions need to recognise and consider the consequences of the influence that developers/designers have on the learning experience (Gyldendahl Jensen et al., 2022; Selwyn, 2016). The OECD emphasises that increasing speed of change necessitates a shift from traditional teacher-led teaching methods' focusing on 'knowledge transfer to student-centred forms of education such as inquiry-based learning, problem-based learning, reflective practice-based learning, challenge-based learning, e.g. focusing on the development of needed competences (OECD, 2019).

Therefore, the article conceptualises **Experiential and Collaborative learning (ECL)** as an overarching approach to capturing an array of established and complex educational methods or pedagogical models. Through systematic desk research, several pervasive key concepts on the nature of ECL have been derived. Based on those keywords, a systematic literature study within the database of ECEL articles from 2012 to 2021 is conducted to investigate and articulate the potential gap often seen between pedagogical and technological development. Therefore, the research question is twofold: ***"How is ECL addressed in ECELs papers" and "What is the potential gap*** **transforming ECL to digital solutions"?**

The article will initially explain the terminology of ECL to derive ontologically key concepts and positions to answer the research question, which will be followed by a systematic literature review. *Based on the included articles, capturing the complexity of ECLs, potentials and gaps are identified and* presented, and finally, the article concludes on the findings and calls for further research.

2. The ontology of Experiential Collaborative learning (ECL)

Experiential and Collaborative learning (ECL) is in this article used as an overarching concept to capture an array of established educational approaches or pedagogical models, such as Problem-Based Learning (PBL), Inquiry-Based Learning (IBL), Challenge Based Learning (CBC), Reflective Practice-Based Learning (RPL), Discovery-based learning e.g.

One of the key principles behind these established educational approaches or pedagogical models that constitute ECL is the notion of learning through experiencing and experimenting. The positions use different terminologies to describe the learning processes, such as exploration, inquiry, investigation, or discovery, but generally come from the same ontological understanding of learning. All these theoretical positions that together can be characterised as ECL have in common that they draw on epistemological perspectives related to, e.g. constructivism, social constructivism, and socio-cultural theory, where learning is seen as the link between theory and practice. Within this field, pragmatism in particular, and thus the theoretical legacy of e.g. Dewey's work, inspired several positions (Horn et al., 2021; Johnson et al., 2009; Spronken-Smith and Walker, 2010). Dewey writes about how students(re)construct meaning and actions through an experimental approach using tools and artefacts and the social context acts as stimuli that elicit particular reactions (Buch and Elkjær, 2015; Dewey, 1933; Elkjaer and Wiberg, 2013).

Regardless of linguistic definitions, there are similarities between the different theoretical positions or conceptual models. The interpretation of Dewey's ideas about experiential learning manifests itself differently, RPL for example, is based on a coupling of the concepts of experience, thinking and action through exploration (Horn et al., 2021; Jensen, 2020), while PBL is more concerned with an experiential approach through problem identification (Davidsen and Konnerup, 2016), IBL is explicitly based on inquiry processes (Aditomo et al., 2013; Dewey, 1933), and the question or the problem is replaced by challenges in CBL (Baloian et al., 2006; Gallagher and Savage, 2020).

The ontological grounding of ECL is thus founded as an authentic, collaborative process where people and their surroundings are interwoven entities. Thus, collaboration is a common feature within ECL, characterised by ideals of group work and student-led organisation (Davidsen and Konnerup, 2016). Hence, ECL is part of a human and social science tradition that understands learning as something more than just the acquisition of knowledge, and where action and thinking are interdependent and closely linked to and situated in transactions between individuals and their environment through experimenting with authentic real-world problems in a student-centred learning environment.

2.1 Learning through experiencing and inquiry

ECL has its theoretical point of departure in Dewey's work on experiential-based learning, where the concrete and the abstract exist in a relationship of tensions created by challenges, obstacles, and disturbances that arise over time (Dewey, 1933; Dreier, 2016; Horn et al., 2021). Dewey, for example, describes learning as an emotional encounter with an embedded conflict. Often, there is a feeling that something is difficult at the beginning of a learning process; an uncertain situation where concepts such as exploration, investigation, and experimenting are the method of resolving this conflict and making sense (Dewey, 1933; Elkjaer and Wiberg, 2013). The student must diagnose a situation that may be unclear or puzzling to identify practical issues. It

requires the ability to see both practice-related problems and their derivative consequences to consider alternatives and make visible the underlying assumptions (Hüttel and Gnaur, 2017). Understanding a situation is thus very much about manoeuvring in complex interpersonal situations, which requires an exploratory and reflective response to and transformation of the acquired knowledge (Schatzki, 2017).

Processes that are experimental, exploratory, or investigative support the student in recreating meaning in learning situations, where the dynamics and constant movements of reality affect what is being explored and thereby create a lot of disturbances and breakdowns (Dreier, 2016; Horn et al., 2021). Thus, ECL sets specific requirements for the applied pedagogical designs and the surrounding learning environment where practice plays an important role.

Through a systematic exploration of practice, the student is challenged to work analytically and critically to make existing and often implicit and taken for granted premises explicit. Here, in particular, the continuous disturbances will create a need for the students to practice reflective behaviour in order to be able to recognise new knowledge (Jensen, 2020; Siti et al., 2013). Therefore, several established educational approaches or pedagogical models that characterise ECL have the concept of inquiry embedded in the learning process to address complexity (Balım, 2009; Horton et al., 2018; Pedaste et al., 2015).

One way to kickstart the inquiry process is through systematic and planned disruptions or situations that arise spontaneously in the learning process where the student fails. Inquiry-based learning and RPL talk about appropriate disruptions as part of the pedagogical planning (Horn et al., 2021), while challenge-based learning works with the concept of fun-failure where the goal is to create a culture where failing is a way to learn and thus a favourable circumstance (Castronova, 2002). PBL does not speak directly about disturbances but instead how the student needs to practice the capability to respond to changing contexts (Stentoft, 2017).

2.2 Formulating problems as a driver for learning

A very central focus in ECL is the formulation of problems that both acts as natural disturbances in the learning process and at the same time set the direction for the students' work through an inductive approach (Guerra et al., 2017; Holgaard et al., 2014). According to Hüttel and Gnaur (2017), the problem is the central driver for learning and the critical factor for challenging conventional thinking. In Inquiry-based learning, the problem is tightly linked to generating hypotheses (Aditomo et al., 2013; Pedaste et al., 2015), and in challenge-based learning, the learning process actively engages students in relevant real-world problems that exist in their environments and that require a solution (Portuguez Castro and Gómez Zermeño, 2020).

The array of established educational approaches or pedagogical models that characterise Experiential and Collaborative learning (ECL) is an overarching concept to capture an array of established educational approaches or pedagogical models that differ according to the necessity of finding a solution to the problem (Kolmos, 1996). Challenge-based learning, in particular, focuses on working with real-world issues that students then must translate into solutions of local applicability (Johnson et al., 2009), but also inquiry-based learning talks about a complex real-world problem to solve through a specific scientific and experimental methodology (Aditomo et al., 2013). While 4 of the presented pedagogical models focus on formulating problems as a driver, reflective practice-based learning (RPL) focuses more heavily on how professional judgment entails different dilemmas. RPL stresses that normative beliefs, aesthetic judgments, emotions, and the intersection between theory and practice creates different challenges (Horn et al., 2021). Regardless of the differences in emphases of problems in the learning process, there seems to be agreement on how real-life matters and empirical exploration causes a need for reflection, critical thinking and problem identification (Friesen and Scott, 2013; Hüttel and Gnaur, 2017; Portuguez Castro and Gómez Zermeño, 2020).

Based on the above theoretical description of ECL covering Problem-Based Learning (PBL), Reflective Practice-based Learning (RPL), Inquiry-based learning (IBL), Challenge-based learning (CBL) and Discovery learning (DL), a systematic literature review is elaborated in the next section to investigate and summarize the potential gap often seen between pedagogical and technological development.

3. Research method

A systematic literature review following the PRISMA 2020 guidelines (Page et al., 2021) was conducted centred around ECEL publications. The ECEL conference proceedings are listed or indexed in several different scientific

databases, among others Web of Science, SCOPUS, and ProQuest. In these databases, the identified ECL positions and key-concept and their abbreviations were queried individually along with the conference proceedings' ISSN number. In order to ensure recency, the search was scoped to articles published between 2012-2021. The keywords generating results were accumulated in a final search string for each of the selected databases. ProQuest generated the largest quantity of results which were thus retrieved for the selection process. The final search string performed in ProQuest can be seen in figure 1.

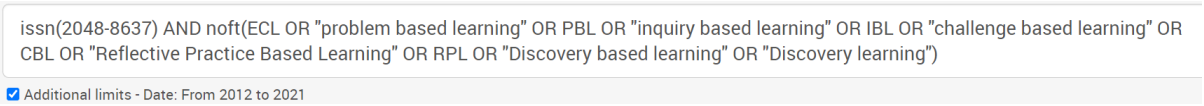

Figure 1: Final search string

Querying the selected database resulted in 32 articles, which were subjected to two iterations of abstract and full text assessment performed by four reviewers. In each assessment round, the inclusion of articles was based on the following criteria: 1) the article must focus on higher education, 2) there should be a pivotal focus upon digital technologies, and 3) there should be a pivotal focus upon technology *usage* in a learning context rather than implementation from an organizational and management perspective. The selection process resulted in an exclusion of 5 articles based on the assessment of abstracts and 4 articles from the full text assessment (figure 2).

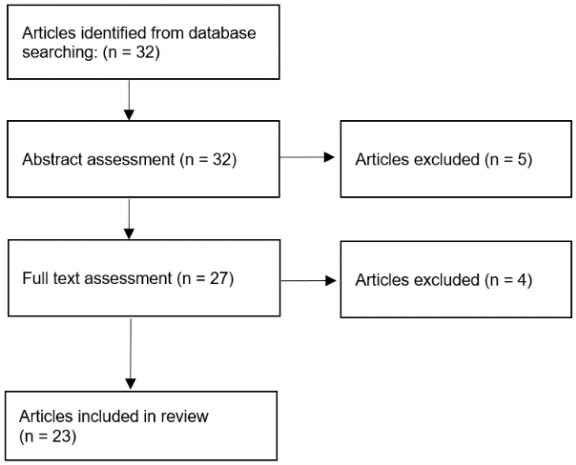

Figure 2: Flow diagram of the identification and selection process

The final pool of articles included in the review were subjected to a mapping process based on categories related to general characteristics (e.g., publication year and country), technologies of investigation, as well as the overall pedagogical model and some of the identified key concepts related to ECL (e.g., social context, interdisciplinarity, and problem orientation). The analysis was carried out on the basis of prevalent themes that emerged from the mapping process.

4. Results and discussion

Table 1 displays key information extracted from the 23 articles included in the review. The articles were mapped in accordance with the underpinning pedagogical model as well as the geographical setting of the research, which showed a predominance of publications centered around PBL (n = 16), while the remaining 4 identified pedagogical models were present in 1-2 articles each (figure 4). The geographical distribution has shown a predominance of Danish publications (n = 10) out of which the majority attributes a PBL model and more specifically the Aalborg University (AAU) PBL model (n = 9), while the remaining 10 countries are represented in 1-2 articles.

Table 1: Included articles

Authors	Year	Country	Research design	Pedagogical model
Andersen, Hüttel & Gnaur	2021	Denmark	Survey	Problem-based learning
Ørngreen, Henningsen & Hautopp	2021	Denmark	Explorative case study	Problem-based learning
Andersen & Dau	2020	Denmark	Mixed methods	Reflective practice-based learning
Recke & Perna	2020	Italy	Presentation of a narrative experience design and adaptation in remote learning scenarios	Challenge-based learning
Gnaur, Hindhede & Andersen	2020	Denmark	Survey	Problem-based learning
Jonasen & Gram-Hansen	2019	Denmark	Semi-structured pilot study	Problem-based learning
Hautopp & Ejsing-Duun	2019	Denmark	Explorative case study	Problem-based learning
Barber, van Oostveen & Childs	2019	Canada	Theoretical	Problem-based learning
Ørngreen, Knudsen, Kolbæk & Jensen	2019	Denmark	Mixed-methods, design-based	Problem-based learning
Lambie & Law	2018	UK	Focus group	Problem-based learning
Gnaur & Hüttel	2018	Denmark	Design-based	Problem-based learning
Kotsifakos, Vichou & Douligeris	2018	Greece	Design-based	Problem-based learning
Elgeddawy	2018	Saudi Arabia	Survey	Inquiry-based learning
Alafouzou, Lamprinou & Paraskeva	2018	Greece	Design-based	Problem-based learning
Juskeviciene & Kurilovas	2017	Lithuania	Expert evaluation method	Problem-based learning
Dau & Rask	2017	Denmark	Design-based	Reflective practice-based learning
Shnai	2017	Finland	Literature review	Problem-based learning
Barber	2016	Canada	Qualitative narrative examination	Problem-based learning
Sadik	2015	Oman	Longitudinal research design	Active and collaborative learning
O'Sullivan & Krewer	2015	Ireland, Germany, Portugal	Design-based	Problem-based learning
Naidoo & Naidoo	2015	South Africa	Experimental research design	Discovery learning
Loughlin, Warburton, Crane & Sammels	2015	UK	Comparative study	Active and collaborative learning
Ørngreen & Mouritzen	2013	Denmark	Action research study	Problem-based learning

The prevalent themes emerged from the mapping process includes real life problems, collaboration, technologies, and design processes, which will be elaborated upon in the following sections.

4.1 Real life problems

A fundamental focal point across the different pedagogical models is real-life matters and empirical exploration as the driver for the learning process. This is highlighted to varying degrees across the different articles, some of which emphasize the process of solving empirical and complex real-life problems in a PBL context (Gnaur et al., 2020; Jonasen and Gram-Hansen, 2019; Ørngreen et al., 2019), pre-defined problems presented by the instructors (O'Sullivan and Krewer, 2015) or external companies (Dau and Rask, 2017). Other articles describe rather specific pre-defined problems as the initiator of the process of inquiry in CBL (Recke

and Perna, 2020) or solving mathematical equations through discovery learning (Naidoo and Naidoo, 2015). In other cases, focus was redirected from problems to *"(…) open-ended, ill-structured and student-centred tasks and activities"* (Barber, 2016), knowledge sharing among peers (Ørngreen and Mouritzen, 2013), reflection in relation to action (Andersen and Dau, 2020), or the development of desirable skills and attributes such as knowledge acquisition (Juskeviciene and Kurilovas, 2017).

4.2 Collaboration

An essential element in ECL is the collaborative aspect, where learning is socially constituted. Here, several studies indicate that E-learning contributes to the formation of social communities both in the classroom and across organizational boundaries (Gnaur and Hüttel, 2018; Kotsifakos et al., 2018; Ørngreen and Mouritzen, 2013; Recke and Perna, 2020). Recke, Perna (2020) writes, for example: *"experiential e-learning principles in the context of Challenges Based Learning can result in increased engagement, motivation and sense of community in learners."* (Naidoo and Naidoo, 2015; Recke and Perna, 2020; Sadik, 2015). However, in the light of Covid19, several studies highlight that transitioning from physical to online learning challenges the social aspects. Andersen, Hüttel, and Gnaur (2021) writes that *"… the social aspects of learning suffered for most, posing challenges for both teaching and group work during the transition to online learning during Covid19"*. Again, the same general trend is seen where the theoretical understanding of learning as something taking place in a social context created by human relations is not unfolded. The question of collaboration, for example, is predominantly discussed based on the technologies used. In other words, how does technology contribute, for example, to the students being able to collaborate in groups on a digital platform, or what competencies are necessary to use a particular technology that demands contextual understanding and practical experience (Hautopp and Ejsing-Duun, 2019).

4.3 Technologies

Several articles are based upon applications of flipped learning approaches (Barber, 2016; Elgeddawy, 2018; Lambie and Law, 2018; Loughlin et al., 2015; Sadik, 2015; Shnai, 2017), involving video lectures, related materials, online quizzes (Sadik, 2015), video podcasts (Barber, 2016), and open online video lectures (Elgeddawy, 2018) as preparation prior to the teaching delivery consisting of e.g. online synchronous tutorials (Lambie and Law, 2018) or synchronous video conferences (Barber, 2016). Video production is also addressed as a teaching format for the purpose of establishing a joint online design inquiry by both students and teachers (Hautopp and Ejsing-Duun, 2019) and supporting students to be reflective in different PBL-based settings (Ørngreen et al., 2019). Similarly, Andersen & Dau (2020) investigate how the use of podcasts can increase students' reflection skills and understanding of a topic before attending class. Another frequently mentioned technology is LMS (Alafouzou et al., 2018; Kotsifakos et al., 2018; Naidoo and Naidoo, 2015; Ørngreen et al., 2019; O'Sullivan and Krewer, 2015), which is often addressed from a design-based approach, e.g. the design of an online course integrating gamified elements in the LMS (Alafouzou et al., 2018) or the design of a new PBL-LMS that facilitates instructors in structuring projects (O'Sullivan and Krewer, 2015). Other online platforms include video conference systems (Dau and Rask, 2017; Ørngreen and Mouritzen, 2013), web-based platform for supervisor competence development (Gnaur and Hüttel, 2018), and more generally digital learning environments (Andersen et al., 2021; Barber et al., 2019).

A large proportion of the articles conclude that the inclusion of technologies that support different forms of E-learning has a positive impact in terms of achieving a higher level of learning expressed through the keywords that also characterize ECL. The studies indicate that the students became better at identifying a real-world problem, problem-solving, reflection, engagement, working collaborative, and valuing intuition and creativity. (Andersen and Dau, 2020; Barber, 2016; Jonasen and Gram-Hansen, 2019; Juskeviciene and Kurilovas, 2017; Kotsifakos et al., 2018; Ørngreen et al., 2021; O'Sullivan and Krewer, 2015). However, when reading the selected articles, it is striking that the majority does not mention the relationship or the link between technology and learning theory on a theoretical level. The studies state that an ECL-based teaching approach is used, for example PBL, but the origin of the learning theory is not specified or elaborated in detail. A single study by Ørngreen, Knudsen, Kolbæk and Jensen (2019) even points out this problem: *"This finding is intriguing, as PBL comprise the pedagogical foundation of AAU, but use of Moodle does not reflect this. The investigation found several reasons for the lack of PBL in Moodle".* Learning is thus discussed primarily based on organizational forms and didactic tools, while the inclusion of theoretical arguments and basic principles is completely absent. Many of the article's state that the learning objectives, for example, is PBL without this being discussed or clarified in detail.

4.4 Design processes

A pervasive aspect across the systematically selected articles is the matter of design. There seems to be a broad consensus that a prerequisite for creating digital learning environments or platforms that can embrace the theoretical dimensions of learning that characterize ECL is a design-based approach. Gnaur, Hindhede, Andersen (2020) conclude, for example *"Hybrid learning environments must be designed in the context of each programme and the specific study elements, and with respect to differences among students regarding their learning needs and preconditions for learning"*. Ørngreen, Henningsen, & Hautopp (2021) and Barber (2016) explicitly talk about an approach where a form of co-designing the learning tasks between educators and students creates better conditions for working with digital form of ECL based teaching. Shnai (2017) also points out that the challenges and barriers encountered by the students primarily concern the design aspects of e-learning.

However, none of the studies found addresses the concept of design in detail, and learning designs are used extensively without an explanation of how these designs are created or which design theory are used in the process. Being a E-learning designer requires, according to Ørngreen, Henningsen, & Hautopp (2021), a "creative production pedagogy" where the students can influence their learning process, including the possibility of selecting and working with methods and tools that are most appropriate and rewarding in a given situation. This perspective challenges the tension between the technologies' facilitation possibilities while preserving the learner's autonomy. Ørngreen, Henningsen, & Hautopp (2021) talk about how an ECL based teaching strategy requires the courage to embrace uncertainty. It means that students must be able to *"navigate through the digital landscape, emerging unscathed with a few inevitable bumps and bruises".* This statement specifically addresses ECL, where disruption is seen as a prerequisite for learning (Barber, 2016; Ørngreen et al., 2021).

5. Conclusion

This article has applied ECL as an overarching term for complex models of learning through experiencing and experimenting centered around authentic and collaborative processes. Based on initial desk research, several ECL positions and key concepts have been identified, which formed the basis of a systematic literature review centered around ECEL publications. The findings shed light on a gap between intended pedagogical underpinnings and technological development, as the theoretical link between them is generally absent or not substantially addressed, although several articles conclude that the technologies of investigation did have a positive impact on learning in general. Furthermore, a large portion of the selected articles claim to adopt a design-based approach to the development of digital learning environments or learning designs but fall short in accounting for the design process on a methodological and theoretical level. Further research is thus needed to address the theoretical link between technological development and the complex ECL models as well as the process of transforming this insight into digital solutions through design.

References

Aditomo, A., Goodyear, P., Bliuc, A.-M., Ellis, R.A., 2013. Inquiry-based learning in higher education: principal forms, educational objectives, and disciplinary variations. Stud. High. Educ. 38, 1239–1258. https://doi.org/10.1080/03075079.2011.616584

Alafouzou, A., Lamprinou, D., Paraskeva, F., 2018. Gamified Project Based Learning Environment for Motivation Improvement. Eur. Conf. E-Learn. 10-17,XII.

Albæk, K., 2018. Den teknologiske udvikling og kompetencer på fremtidens arbejdsmarked. En litteraturoversigt. Vive.dk.

Andersen, E., Hüttel, H., Gnaur, D., 2021. Going Online: Student Perspectives in a Problem-Based Learning Environment During the Pandemic. Eur. Conf. E-Learn. 42-49,XIII,XVI. https://doi.org/10.34190/EEL.21.031

Andersen, R.H., Dau, S., 2020. The Potential of Podcasts as a Learning Medium in Higher Education. Eur. Conf. E-Learn. 16-22,XII,XIV. https://doi.org/10.34190/EEL.20.137

Balım, A.G., 2009. The Effects of Discovery Learning on Students' Success and Inquiry Learning Skills. Eurasian J. Educ. ….

Baloian, N., Hoeksema, K., Hoppe, U., Milrad, M., 2006. Technologies and Educational Activities for Supporting and Implementing Challenge-Based Learning, in: Kumar, D., Turner, J. (Eds.), Education for the 21st Century — Impact of ICT and Digital Resources, IFIP International Federation for Information Processing. Springer US, Boston, MA, pp. 7–16. https://doi.org/10.1007/978-0-387-34731-8_2

Barber, W., 2016. Critical Reflective Practice in Digital Pedagogy: Embracing Creativity in Problem-Based Learning Environments. Eur. Conf. E-Learn. 65–70.

Barber, W., van Oostveen, R., Childs, E., 2019. Situating Resilience, Grit and Growth Mindset as Constructs of Social Presence in the Fully Online Learning Community Model (FOLC). Eur. Conf. E-Learn. 65-69,XI. https://doi.org/10.34190/EEL.19.012

Buch, A., Elkjær, B., 2015. Pragmatism and practice theory.

Castronova, J.A., 2002. Discovery Learning for the 21 st Century : What is it and how does it compare to traditional learning in effectiveness in the 21 st Century ? [WWW Document]. URL https://www.semanticscholar.org/paper/Discovery-Learning-for-the-21-st-Century-%3A-What-is-Castronova/2171dc0a8c7e510c6f95b714f06b8bdebb0a0d74 (accessed 6.9.22).

Dau, S., Rask, A.B., 2017. Connecting eye to eye: The Challenge of Computer Supported Contact. Eur. Conf. E-Learn. 124–131.

Davidsen, J., Konnerup, U., 2016. Revitalisering af PBL i videregående uddannelser gennem Learning Design. Tidsskr. Læring Og Medier LOM 9. https://doi.org/10.7146/lom.v9i15.23126

Dewey, J., 1933. How we think: a restatement of the relation of reflective thinking to the educative process. D.C. Heath and company, Boston, New York [etc.].

Dreier, O., 2016. Conduct of everyday life: Implications for critical psychology, in: Psychology and the Conduct of Everyday Life. Routledge/Taylor & Francis Group, New York, NY, US, pp. 15–33.

Elgeddawy, M., 2018. Impact of Analyzing Open Online Educational Video on University Students' Academic Performance. Eur. Conf. E-Learn. 726–730.

Elkjaer, B., Wiberg, M., 2013. Læringsteori og didaktik. Hans Reitzel, Kbh.

Friesen, S., Scott, D.S., 2013. Inquiry-Based Learning: A Review of the Research Literature. undefined.

Gallagher, S.E., Savage, T., 2020. Challenge-based learning in higher education: an exploratory literature review. Teach. High. Educ. 0, 1–23. https://doi.org/10.1080/13562517.2020.1863354

Georgsen, M., 2021. Experiences of Online Teaching at 9 Institutions of Higher Education in Spring 2020. Summary.

Gnaur, D., Hindhede, A.L., Andersen, V.H., 2020. Towards Hybrid Learning in Higher Education in the Wake of the COVID-19 Crisis. Eur. Conf. E-Learn. 205-211,XV. https://doi.org/10.34190/EEL.20.093

Gnaur, D., Hüttel, H., 2018. Building a new Community Around a Platform for Developing PBL Competences. Eur. Conf. E-Learn. 161-168,XIV-XV.

Guerra, A., Rodriguez, F.J., Kolmos, A., Reyes, I.P. (Eds.), 2017. PBL, Social Progress and Sustainability, International Research Symposium on PBL. Aalborg Universitetsforlag, Aalborg.

Gyldendahl Jensen, C., Clausen, N.R., Ryberg, T., Dau, S., Bertel, L.B., 2022. Envisioning scenarios in designs for Networked Learning: Unfolding value tensions between technology and social learning. Networked Learn. 2022.

Hautopp, H., Ejsing-Duun, S., 2019. The use of Visualisations and Video Productions in Online Game- Based Learning. Eur. Conf. E-Learn. 192-199,XIII. https://doi.org/10.34190/EEL.19.094

Holgaard, J.E., Ryberg, T., Stegeager, N., Stentoft, D., Thomassen, A.O., 2014. PBL: Problembaseret læring og projektarbejde ved de videregående uddannelser. Samfundslitteratur, Frederiksberg C.

Horn, L.H., Pedersen, P.M., Georgsen, M., 2021. Teori og praksis i professionsdidaktik: En bog om refleksiv praksislæring. Aalborg Universitetsforlag.

Horton, P.A., Jordan, S.S., Weiner, S., Lande, M., 2018. Project-Based Learning Among Engineering Students During Short-Form Hackathon Events. Presented at the 2018 ASEE Annual Conference & Exposition.

Hüttel, H., Gnaur, D., 2017. If PBL is the answer, then what is the problem? J. Probl. Based Learn. High. Educ. 5. https://doi.org/10.5278/ojs.jpblhe.v5i2.1491

Jensen, C.G., 2020. Playing with Sequential Learning and and Inquiry Processes by Bringing "World of Warcraft" to the Real World: Based on Reflective Practice-based Learning. Aalborg Universitetsforlag.

Johnson, L.F., Smith, R.S., Smythe, J.T., Varon, R.K., 2009. Challenge-Based Learning: An Approach for Our Time. New Media Consort.

Jonasen, T.S., Gram-Hansen, S.B., 2019. Problem Based Learning: A Facilitator of Computational Thinking. Eur. Conf. E-Learn. 260-267,XII. https://doi.org/10.34190/EEL.19.150

Juskeviciene, A., Kurilovas, E., 2017. On Linking Problem-Based Learning Activities and Students' Learning Styles in Personalised Learning. Eur. Conf. E-Learn. 238–246.

Kolmos, A., 1996. Reflections on Project Work and Problem-based Learning. Eur. J. Eng. Educ. 21, 141–148. https://doi.org/10.1080/03043799608923397

Kotsifakos, D., Vichou, M., Douligeris, C., 2018. Organization of a Teaching Network Routing Algorithms Scenario in a Learning Management System (LMS). Eur. Conf. E-Learn. 263-272,XV.

Lambie, I., Law, B., 2018. Tutor Perception of Delivery Mechanisms for Online Tutorials. Eur. Conf. E-Learn. 290-298,XVI.

Loughlin, C., Warburton, S., Crane, S., Sammels, W., 2015. Towards Active Learning Spaces and the Flipped Classroom Model. Eur. Conf. E-Learn. 322–XV.

Naidoo, K., Naidoo, R., 2015. Exploring a Blended Learning Model to Teach First Year Mathematics Education Students Trigonometry at a UoT. Eur. Conf. E-Learn. 719–XVI.

OECD, 2019. Trends Shaping Education 2019. OECD Publishing, Paris.

Ørngreen, R., Henningsen, B., Hautopp, H., 2021. Creative Audio-Visual Approaches Applied in Online and Hybrid Educational Designs. Eur. Conf. E-Learn. 329-338,XV,XVIII. https://doi.org/10.34190/EEL.21.096

Ørngreen, R., Knudsen, S.P., Kolbæk, D., Jensen, R.H.S., 2019. Investigating the use of Moodle at a PBL University: Design Factors and Experiences. Eur. Conf. E-Learn. 444-452,X. https://doi.org/10.34190/EEL.19.144

Ørngreen, R., Mouritzen, P., 2013. [Teaching Desktop] Video Conferencing in a Collaborative and Problem Based Setting. Eur. Conf. E-Learn. 360–XV.

O'Sullivan, D., Krewer, F., 2015. Structured Approach to Project Based Learning using a new type of Learning Management System. Eur. Conf. E-Learn. 460–XVII.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P., Moher, D., 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 372, n71. https://doi.org/10.1136/bmj.n71

Pedaste, M., Mäeots, M., Siiman, L.A., de Jong, T., van Riesen, S.A.N., Kamp, E.T., Manoli, C.C., Zacharia, Z.C., Tsourlidaki, E., 2015. Phases of inquiry-based learning: Definitions and the inquiry cycle. Educ. Res. Rev. 14, 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

Portuguez Castro, M., Gómez Zermeño, M.G., 2020. Challenge Based Learning: Innovative Pedagogy for Sustainability through e-Learning in Higher Education. Sustainability 12, 4063. https://doi.org/10.3390/su12104063

Recke, M.P., Perna, S., 2020. Narratively Driven Educational Experiences in Remote Learning Scenarios. Eur. Conf. E-Learn. 438-444,XIX. https://doi.org/10.34190/EEL.20.062

Sadik, A., 2015. The Effectiveness of Flipped Lectures in Improving Student Engagement and Satisfaction. Eur. Conf. E-Learn. 507–XVII.

Schatzki, T., 2017. Practices and Learning. pp. 23–43. https://doi.org/10.1007/978-981-10-3130-4_2

Selwyn, N., 2016. Is Technology Good for Education? John Wiley & Sons.

Shnai, I., 2017. Systematic Review of Challenges and Gaps in Flipped Classroom Implementation: Toward Future Model Enhancement. Eur. Conf. E-Learn. 484–490.

Siti, M., Tajuddin, A., Jailani, A., 2013. Challenge Based Learning in Students for Vocational Skills. Int. J. Indep. Res. Stud. - IJIRS 2, 89–94.

Spronken-Smith, R., Walker, R., 2010. Can inquiry-based learning strengthen the links between teaching and disciplinary research? Stud. High. Educ. 35, 723–740. https://doi.org/10.1080/03075070903315502

Stentoft, D., 2017. From saying to doing interdisciplinary learning: Is problem-based learning the answer? Act. Learn. High. Educ. 18, 51–61. https://doi.org/10.1177/1469787417693510

Analysis of Approaches to the use of ICT in the Teaching of Mathematics

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Abstract: Information and communication technologies (ICT) play an increasingly important role in learning and teaching. The way they are used in specific lessons is influenced by a number of factors, one of the most important of which is the teacher's beliefs about the use of ICT in education. The way teachers think about modern technologies is very important and greatly influences how they use ICT in their teaching. Our paper presents a partial output of research focusing on the influence of teachers' beliefs on the use of ICT in teaching. Within the presented research, lessons of several mathematics teachers were recorded longitudinally. The recordings from classes were subsequently coded by a team of researchers and analysed in detail on the basis of Grounded theory. Several different aspects of teaching were observed in the analysis: Forms of instruction, Teacher-pupil communication, Pupil activities at the blackboard, Pupil activity on PC or laptop, ICT involvement, Teacher activities, Phenomena in teaching using ICT, Used programs and applications and Testing. The results of this analysis were then compared with how teachers think about the use of ICT and how they characterize their own use of ICT in teaching. Even though all the monitored teachers characterized themselves as experienced users of ICT, the way they used technologies in their teaching was very different and often differed greatly from the positions they declared. As part of the paper, we present a comparison of the teaching styles of individual teachers and a comparison of their beliefs and proclamations with the reality that was observed in the lessons. Attention will also be paid to the impact of the actual use of ICT on the overall course of the lesson and the activity of the pupils. The results of the research show that the way in which the teacher's beliefs affect teaching is really crucial.

Keywords: ICT in education, interactive whiteboards, teachers' beliefs, mathematics education

1. Introduction

This paper presents partial results of a research that was part of the dissertation of one of the authors of the article (Havelková, 2021). It is an analysis of lessons of three mathematics teachers, focusing on the relationship between the use of information and communication technologies in teaching and their beliefs about the role technologies should play in education. The research has shown that although all three teachers have described themselves as experienced users of technology in their teaching, the reality we encounter in their lessons is quite different. An important finding is the fact that it is not enough just to observe whether and for how long technologies are used in lessons. We must also focus on how they are used. The mere presence of technology in lessons may not in itself be an indicator that technology supports teaching and learning. This is shown especially in the use of data projectors and interactive whiteboards that are used by the teachers but the way they are used brings nothing in addition to what classical teaching aids bring.

2. Use of ICT and teachers' beliefs

The role ICT plays in education has been growing. This even more in consequence to the two years of the pandemic that drastically limited the possibility of teaching on-site and that brought emergency remote education (Bozkurt, Sharmaa, 2020). In this period, the vast majority of teachers began to use ICT. Even after returning to presence teaching, ICT is used much more intensively than before. However, the method and intensity of its use varies from school to school and from teacher to teacher. The use of computers is affected by a number of factors. Liu (2011) identifies thirty individual items that might affect using technology and through factor analysis defines six factors derived from these items. These factors are teaching implementation, instructional design, teachers' individual mindset, external expectations, school support, and student achievement. Although this list of factors is rich, it is not exhaustive. We focus on teachers' individual mindset. These factors describe a mindset of individual teachers, which comes from their personal characteristics (settings). These factors include teacher's resistance to adopting new approaches (Handel, 2003), their risk-aversion (Howard, 2013), personal self-confidence and teaching self-confidence (Stipek at al, 2001), desire for professional development. These factors may or may not be connected with their personal beliefs or teacher beliefs. Teachers§ beliefs are "the individual conceptions about desirable ways of teaching

and conceptions about how students come to learn" (Beijaard, 1998). Teacher beliefs have been studied in many papers (e.g., Blay & Ireson, 2009, Zohar, Degani, & Vaaknin, 2001, Correa at al, 2008). Much research shows that teacher beliefs have a strong impact on teaching practices across different classes and grade levels (Kagan, 1992; Kane, Sandretto & Heath, 2002; Pajares, 1992) because beliefs influence teachers' behaviours (Ajzen & Madden, 1986) and have stronger influence on teachers than knowledge (Kagan, 1992; Pajares, 1992; Nespor, 1987). Studies show that teachers' beliefs are key to making teachers´ decision about integrating technology (Becker, 2001; Dede, 2000). They could be helpful for integrating technologies but at the same time, they could be a barrier (Ertmer, 2005). But despite the fact that teachers' beliefs affecct the use of technology, they are not always consistent with real classroom practices (Ertmer et al., 2001) and the relationships between teachers' beliefs and classroom practices are not direct (Fang, 1996; Kane, Sandretto & Heath, 2002) because there are many other factors that have impact on its actual use.

3. Research methodology

The main part of the research was the analysis of recordings of lessons of three teachers (Rudolf, Petr, Jana). Mathematics lessons of each of them were video recorded for two weeks. A total of 43 teaching lessons (see Table 1) were recorded in different classes. In the end, only one class of each of the teachers was included in the detailed analysis, which, in the authors' opinion, best described their typical approach to teaching and technology. The detailed analysis thus worked only with 25 lessons.

Table 1: Number of recorded and selected lesson

	Number of recorded lessons	Selected for research
Rudolf	9	9
Petr	14	7
Jana	20	9

The video recordings were made on a camera on a tripod. It is important for the validity of the results that no changes in pupils' and teachers' behaviour could be observed after the installation of the camera. In accordance with the Grounded theory, the video recordings were coded in the Atlas.ti programme (see Figure 1).

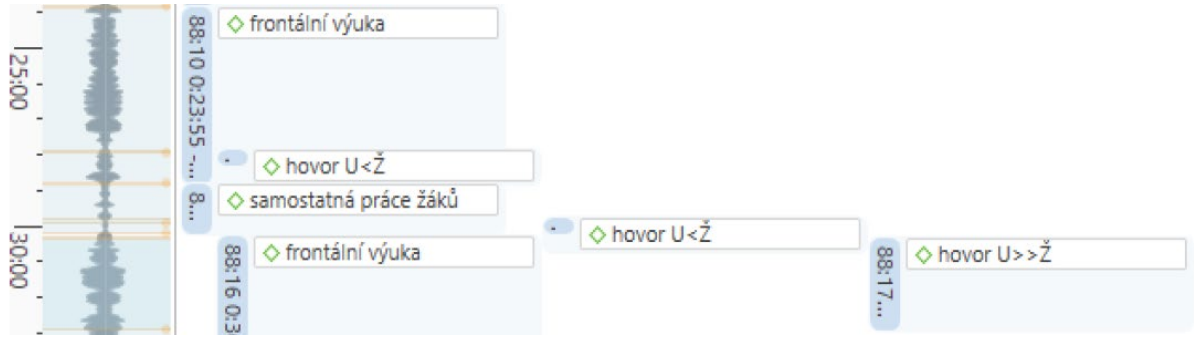

Figure 2: Atlas.ti programme

The lessons were described in detail with a focus on the teacher's activities, and at the same time these lessons were coded and annotated. Multi-level codes were used for videos where individual phenomena were classified or categorized. The results were then compared with the attitudes that teachers declared in semi-structured interviews

The default codes were created by analysing several videos from each teacher by the three authors of this paper. Some codes were pre-designed, some were created during the initial analysis, others were created during the detailed analysis of other lessons. A total of 46 codes were created and used. These were divided into 9 categories:

- 1. Pupil's activity on PC or laptop
- 2. Teacher's activities
- 3. Forms of instruction
- 4. Phenomena in teaching using ICT
- 5. Used programmes and applications
- 6. Teacher-pupil communication

- 7. Pupil's activities at the blackboard
- 8. ICT involvement
- 9. Testing

Codes were used in the total of 722 cases and indicated not only the occurrence of a phenomenon but also the time of its duration (a total of 591 time periods were marked).

4. Results

4.1 Characteristics of the teachers

Let us first present the characteristics of the observed teachers. They show that in all three cases they are very experienced teachers with good knowledge of computer technology. All three actively attend in-service teacher training. They work at various schools in different towns in the Czech Republic.

4.1.1 Rudolf

Rudolf has been teaching for about 15 years. He studied mathematics, physics and computer science. He currently teaches computer science and works as a network administrator at his school. He now teaches mathematics less and only to older pupils. On average, he attends in-service training courses for teachers of mathematics or computer science once a year (the last one focused on GeoGebra). Rudolf claims to be rather sceptical about the use of technology in teaching. The school management does not put too much pressure on teachers to use technology in teaching or in other areas.

Rudolf teaches in a classroom equipped with a computer and a data projector that he uses in all of his lessons. He cannot teach in a computer lab and does not have the opportunity to use an interactive whiteboard.

4.1.2 Petr

Petr has been teaching for 43 years. From the beginning of his career he has been teaching mathematics. His study fields were mathematics and technology for lower secondary schools. He has been the school headmaster for twenty years. Petr attends various seminars very often, usually at least once a month, and is a lecturer of SMART interactive whiteboards. He thinks that modern technology can help pupils develop their imagination. As the headmaster, he made the decision to replace traditional whiteboards with interactive ones.

In his lessons, Petr only uses interactive whiteboard, he does not teach in a computer lab, nor does he have computers available for individual pupils.

4.1.3 Jana

Jana has been teaching for 26 years and has been teaching mathematics and chemistry since the beginning of her career. She is currently the Deputy Headmistress. According to Jana, effective teaching means that the teacher should speak as little as possible in the lessons. Then pupils learn from each other and the teaching is more of a dialogue than mere frontal teaching. Her point of view of technology in the classroom is that it is a helper. She regards herself as a pioneer as she has one lesson of math a week with tablets. With one of her classes that is smaller, they go to the computer lab to practice. A number of programmes for practicing mathematics are installed there.

Jana has her classroom equipped with an interactive whiteboard, she can use a notebook and can have her lessons in the computer lab.

4.2 Extent of the use of ICT in lessons

The first information about the use of ICT in lessons can be found in an overview of the time for which two basic technologies were used in the lessons – the interactive whiteboard and the data projector (see Figure 2). This overview shows that Rudolf used a computer in the lessons least. He did not have an interactive whiteboard in the classroom and turned on the data projector in less than half of the lessons.

On the other hand, Petr, who did not have an ordinary whiteboard in the classroom, used the interactive whiteboard in all of his lessons. There was no situation in which he would only turn on the beamer without using the interactive whiteboard. Jana combined both technologies in her lessons. In most of her lessons, the use of interactive whiteboard dominated. In two cases, she used both the interactive whiteboard and the data projector without the interactive whiteboard in the lesson. However, there were also two lessons in which she used only the data projector and did not turn on the interactive whiteboard.

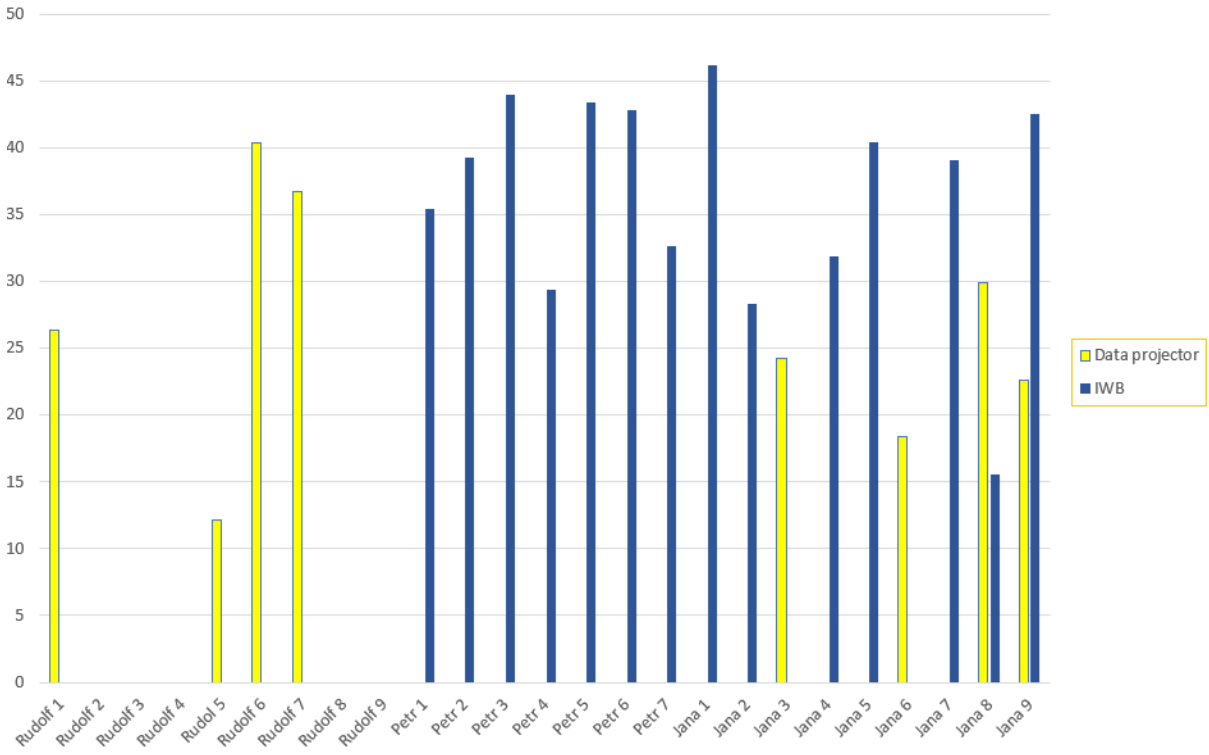

Figure 2: Comparison of data projector and IWB usage

If we focus on the use of the IWB, which is the most commonly used tool in Petr's and Jana's lessons, we must look at how both teachers work with IWB in their lessons. These observations will be treated in separate subchapters.

4.2.1 Petr's lessons

Observations from Petr's lessons show great homogeneity. Frontal teaching predominates in his teaching. Although he tries to interact with pupils, he is in most cases limited to one-word or very short answers to the questions asked.

The IWB is primarily used as an ordinary whiteboard. He uses it with high user confidence. In the analysis of the records from the lessons, we could observe times when, if necessary, he also makes use of functions that differentiate the IWB from an ordinary whiteboard – these are mainly moving of parts of texts (drag and drop) and their formatting or return to the "already deleted whiteboard". He often uses interactive tools that are part of the software that comes with the board. In several lessons he works with the interactive calculator. If necessary, he also uses an interactive whiteboard to project a picture from the visualizer (see Figure 3).

If we look at the applications he uses in his lessons, we can see the use of the GeoGebra programme, both on the side of the teacher and his pupils in their mobile devices (see Figure 4).

4.2.2 Jana's lessons

Jana's teaching was very diverse. Once a week, she taught in a computer lab. Even in her case, frontal teaching dominated. However, she included various activities in her teaching in which the way of communication changed. As the only one of the observed teachers, she used pupils' group work. In her class, Jana combined writing on a whiteboard, flipchart, interactive whiteboard and a projector. We can see diversity also in the

overview of applications that she used in her teaching. While in Petr's case, the use of SMART Notebook was predominant, Jana, although IWB was also used for writing, predominantly uses other applications (see Figure 5).

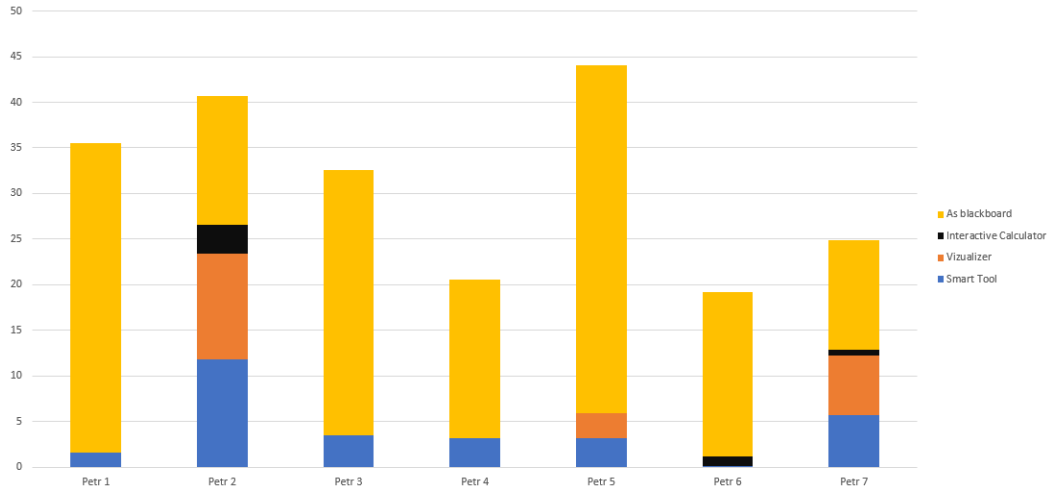

Figure 3: Use of IWB in Petr's hours

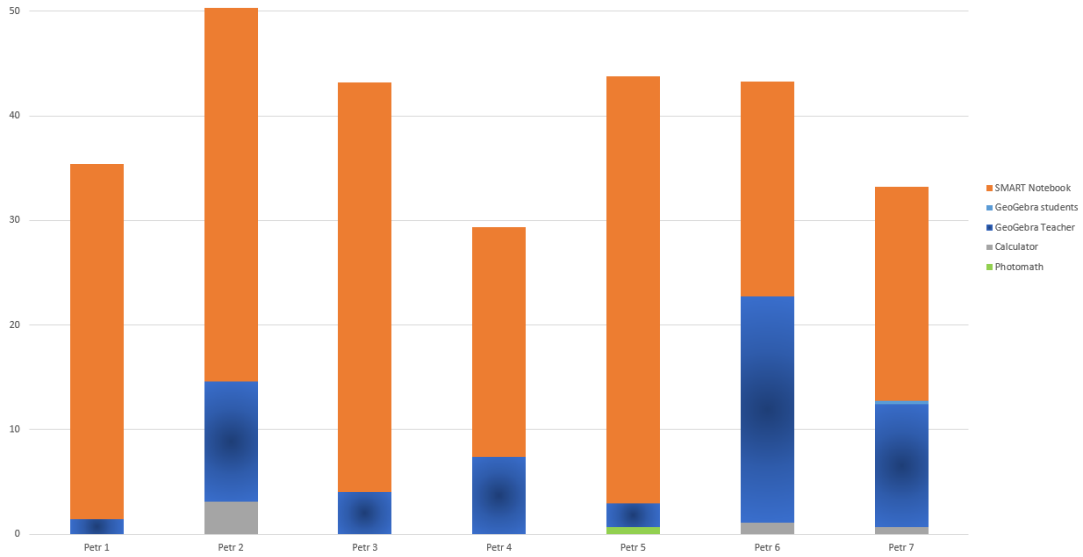

Figure 4: Use of software in Petr's lessons

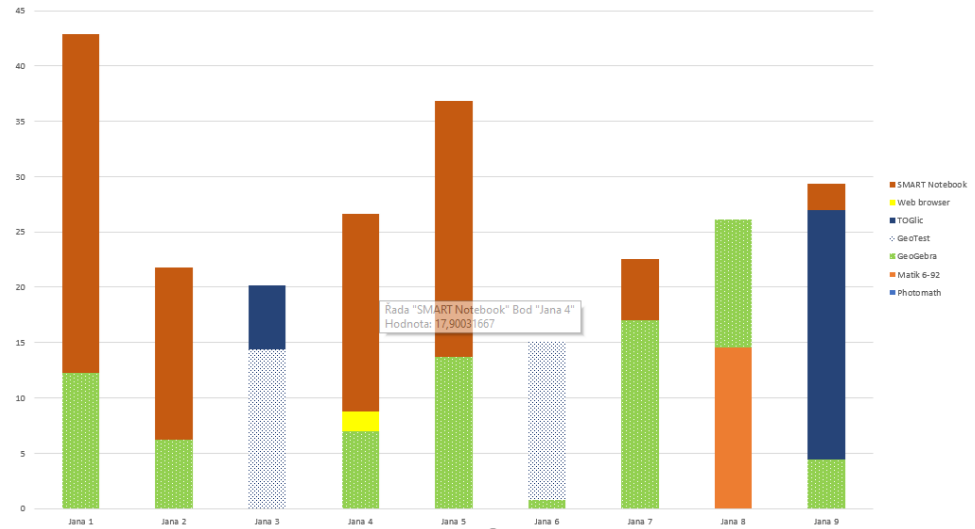

Figure 5: Use of software in Jana's lessons

5. Conclusion

The study, whose partial results are presented in this paper, confirms that the teacher's beliefs in all the observed cases significantly affect the way the teacher actually uses technology in teaching. Rudolf's beliefs led to the fact that he did not perceive modern technologies as helpful with respect to epistemology and therefore he did not include them in this topic.

Petr was, on the one hand, not convinced that modern technology really helped pupils more than traditional teaching without technology, but at the same time believed that the dynamism of GeoGebra could make it easier for pupils to understand. These seemingly conflicting views explain Petr's use of the interactive whiteboard most of the time as a whiteboard, with the exception of dynamic models created in GeoGebra when he used its interactivity.

Jana's beliefs were related to the fact that dynamism can make it easier for pupils to understand the topic, to the belief they need drill, and to the fact that pupils' independent control of programmes leads to more precision. This was reflected in particular in the fact that Jana was the only one to lead the pupils to independent use of modern technologies. However, the pupils used technology exclusively for practice.

Acknowledgements

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References

Ajzen, I. and Madden, T. J. (1986) Prediction of goal-directed behavior: attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology*, Vol. *22*, pp 453–474.

Beijaard, D. (1998) Persoonlijke onderwijstheorieën van leraren [Personal educational theories of teachers]. In J. Vermunt and L. Verschaffel (Eds.), *Onderwijzen van kennis en vaardigheden* [Educating knowledge and skills]. Alphen aan den Rijn. The Netherlands: Samson.

Becker, H. J. (2001) How are teachers using computers in instruction? Paper presented at the annual meeting of the *American Educational Researchers Association*, Seattle, April, 2001.

Blay, J. A. and Ireson, J. (2009) Pedagogical beliefs, activity choice and structure, and adult child interaction in nursery classrooms. *Teaching and Teacher Education*, Vol. *25*, pp. 1105–1116.

Bozkurt, Aras; Sharma andRamesh C. (2020) Emergency remote teaching in a time of global crisis due to CoronaVirus pandemic. *Asian Journal of Distance Education*, 15.1: i-vi.

Correa, C. A., Perry, M., Sims, L. M., Miller, K. F. and Fang, G. (2008) Connected and culturally embedded beliefs: Chinese and US teachers talk about how their students best learn mathematics. *Teaching and Teacher Education*, Vol. *24*, pp 140–153.

Dede, C. (2000). Emerging influences of information technology on school curriculum. *Journal of Curriculum Studies*, Vol 32, No. 3, pp 281–303.

Ertmer, P. A. (2005) Teacher pedagogical beliefs: the final frontier in our quest for technology integration? *Educational Technology, Research and Development*, Vol 53, No. 4, pp 25–39.

Ertmer, P. A., Gopalakrishnan, S. and Ross, E. M. (2001) Technology-using teachers: Comparing perceptions of exemplary technology use to best practice. *Journal of Research on Technology in Education*, Vol 33, No. 5.

Fang, Z. (1996) A review of research on teacher beliefs and practices. *Educational Research*, Vol 38, No. 1, pp 47–65.

Handel, B. (2003) Teachers' Mathematical Beliefs: A Review. *The Mathematics Educators*, Vol 13, No. 2, pp 47–57.

Havelková, V. (2021) *The Factors Influencing the Usage of Modern Technologies in Teaching Mathematics* (Doctoral thesis). Prague: Charles University, Faculty of Education.

Howard, S.K. (2013) Risk-aversion: understanding teachers' resistance to technology integration. *Technology, Pedagogy and Education*, Vol 22, pp 357–372.

Kagan, D. M. (1992) Implications of research on teacher belief. Educational Psychologist, Vol 27, No. 1, pp 65–90.

Kane, R., Sandretto, S. and Heath, C. (2002) Telling half the story: a critical review of research on the teaching beliefs and practices of university academics. *Review of Educational Research*, Vol 72, No. 2, pp 177–228.

Nespor, J. (1987) The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, Vol 19, No. 4, pp 317–328.

Pajares, M. F. (1992) Teachers' beliefs and educational research: cleaning up a messy construct. *Review of Educational Research*, Vol 62, No. 3, pp 307–332.

Stipek, D. J., Givvin, K. B., Salmon, J. M. and MacGyvers, V. L. (2001) Teachers' beliefs and practices related to mathematics instruction. *Teaching and Teacher Education*, Vol 17, pp 213–226.

Zohar, A., Degani, A. and Vaaknin, E. (2001) Teachers' beliefs about low-achieving students and higher order thinking. *Teaching and Teacher Education*, Vol 17, pp 469–485.

Artificial Intelligence Assistant for Mathematics Education

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Abstract: The paper presents the partial results of a research study conducted within the project AI Assistant for Pupils and Teachers. The university, non-profit sector and organization established by the Ministry of Education are cooperating on this project. The aim of the project is to prepare an AI assistant for communication with teachers and pupils. The output of the project should be a system that communicates with pupils and teachers. AI assistant will offer them appropriate teaching materials based on their needs. The system will use not only pre-prepared materials (which is the case presented in this paper), but will be able to independently search and evaluate materials in open databases. We primarily focus on supporting the teaching and learning of mathematics and Czech language. In this paper, we focus on one of the partial researches. The aim of this research was to prepare and experimentally test the possibility of using a series of pre-prepared math problems of an increasing difficulty for individual (partly pupil-managed) practice of algebraic expressions. The topic of algebraic expressions was chosen because it is relatively well-structured and is therefore suitable for this method of processing. At the same time, and this is very important, the topics include the so-called critical topics, i.e. topics that cause problems for pupils and where pupils very often seek help. The topic of algebraic expressions is divided into several subchapters, each of which contains about ten steps, consisting of three tasks, one of basic, one of standard and one of higher difficulty, and supporting materials for mastering them. The pupil can decide what difficulty of the task they want to solve and what supporting materials they want to use. The developed application is available to pupils online in the web environment as well as in the form of an app for the mobile phone. The application has already been published and is in a test regime.

Keywords: chatbot, private tutoring, AI chatbot, algebraic expressions, AI in education

1. Introduction

Tutoring is an important part of the education process. Education, which takes place in close interaction between the educator and the pupil, is very effective. It allows adaptation of the educational content to the particular pupil's needs. In the Czech Republic, the vast majority of pupils have experience with some form of tutoring. However, this form of education is very expensive and results in deepening socio-economic inequalities in education. The AI Assistant Project for Pupils and Teachers, in whose solution the authors of this paper are involved, aims at partial automatization of the tutoring process using modern technologies. Thus, it should make tutoring more accessible to a larger group of pupils.

In this paper, we present one of the developed applications – a chatbot designed for tutoring in the area of algebraic expressions in an online environment. There are several reasons why it is this topic that has been selected for testing the functionality of the chatbot environment. The first reason is that it is a topic that was identified as one of the critical areas of mathematics (Rendl et al, 2013), a topic in which pupils have considerable problems. The second reason is that it is a very well-structured topic. And last but not least, implementation of algebraic expressions into the text mode in which the chat takes place is not as complicated as, for example, implementation of topics from synthetic geometry. The application we present in this article combines AI elements in the form of a chatbot with classic programmed learning tools. The application is currently in test regime and can be accessed both on a web interface and through the Telegram chat application.

2. AI in Education (AIEd)

The issue of the potential use of AI in education has been researched and discussed for more than 30 years. Zawacki-Richter at al (2019) present an overview of this research. They identify four major directions of current research in the area of AI in education. These are:

- 1. Profiling and prediction,
- 2. assessment and evaluation,

- 3. adaptive systems and personalisation,
- 4. intelligent tutoring systems.

Intelligent tutoring systems (ITS), which include the AI assistant we develop, are systems in which one-to-one personal tutoring takes place, where the role of the teacher is fully or partially represented by a computer system. Thanks to the use of artificial intelligence, education is becoming more accessible and is becoming a solution even in situations in which traditional online teaching is necessary but unavailable for time, economic or other reasons. However, it is important to realize that there still are and will be differences between the support provided by the teacher and the one provided by AI. Early research shows that using an AI assistant may make communication easier for some pupils (Kim et al, 2020). A.E. Attard (2021) in his bachelor thesis conducts a research focusing on explaining the knowledge from mathematics, according to which 73% of the users enjoyed making use of the chatbot, and the same percentage of respondents also expressed a desire to use the chatbot again in the future.

3. Algebraic expressions

As Stacey, Chick and Kendal (2004, Preface) state "For mass education, algebra teaching highlights questions of equity and relevance. For progression to higher mathematics, students need algebra but its abstraction makes it hard to learn and hard for beginners to see a reason for learning." They speak about school algebra in general, but of course, it is valid also for algebraic expressions we are dealing with in this paper. Algebraic thoughts are seen there as consisting of three components: natural language, symbolic language and compound representations. The analysis of these components suggests that their mastering is not straight. In (Stacey, Chick and Kendal, 2004, 9.3), language aspects that may affect individuals' reading symbolic writings are discussed from the perspective of attributes, which form obstacles for achieving algebraic fluency. An algebraic activity involves operating on the unknown, stating generalization about patters of operations, and making statements about equivalent combinations off operations. Algebraic activity involves operating on the unknown, stating generalization about patters of operations, and making statements about equivalent combinations of operations. Linchevski and Livneh (1999) propose that for successfully use the conventional rules of symbol manipulations. it is necessary for pupils to possess the so-called structural sense. On the one hand, symbolic writings in algebra are compact and powerful, but at the same time, they build obstacles for learners (Stayce, Chick, Kendal, 2004).

MacGregor and Price (1999) observed that pupils with good language skills did not do well when manipulating with algebraic items based on "familiar school algebra tasks". They hypothesized that these pupils "were not sufficiently aware that the algebraic sign system has its own grammatical rules and conventions that are not intuitively obvious and have to be leaned" (p. 462) (see Stacey, Chick, and Kendal, 2004).

In school mathematics traditionally, algebra has been considered as generalisation of arithmetic. In the present understanding, algebra is considered in a much broader perspective. For example, it is an efficient tool when modelling real situations.

In the following text we focus on algebraic expressions as an important part of school algebra. An algebraic expression in mathematics is an expression which is made up of constants, variables and algebraic operations (addition, subtraction, multiplication, division and exponentiation). School mathematics cannot do without the symbolic language of algebraic expressions already on the level of lower secondary school. Without them, the formulations would be often very long and limited. It would make both written as well as spoken communication too complicated. Algebraic expressions offer the way for describing mathematical concepts and relationships among them. But on the other hand, in the reality of teaching mathematics in school, they are often taught in an instructive, formal way without understanding.

Algebraic expressions (expressions with variables), their properties and manipulations with them are one of the domains of school mathematics mostly declared in the interviews with teachers as difficult for pupils, see e.g. (Rendl et al., 2013). There are two main reasons for it presented by teachers: Pupils have difficulties with grasping rules for algebraic expression manipulations and in the era of the use of didactical technology (DT), it can be done by DT. Numerous attempts to withdraw algebraic expressions from the compulsory curricula have been noted in several countries.

At present, in several professions economical thinking and expressing is required. Many professions are based on algorithmic procedures. It supports the importance of dealing with algebraic expressions in the contemporary school mathematics. But it is necessary to motivate pupils for using them and avoid formalism when manipulating with them. Many mathematics teachers are aware of the obstacles pupils encounter when manipulating with algebraic expression (example for one interview with teachers: "What about leaving out operating with fractional algebraic expressions. Anyway, it is like an alchemy for many pupils." Kubínová, Barešová, Hanušová, 1999).

3.1 Distribution of topics

For the purposes of tutoring, the topic of algebraic expressions was divided into 25 subchapters (see Table 1), which build on each other logically and in terms of growing difficulty. A series of 5 tasks was created for each subchapter, where two were easy, one standard and two more difficult. Only one easier and one more difficult task were finally selected for the test regime. A suitable video explaining the phenomenon/phenomena needed to work with the algebraic expressions were added to each subchapter. The videos were usually selected from publicly available sources such as the KhanAcademy or YouTube. As some subchapters were too narrowly focused (for example, the chapter: Multiplying an expression with subtraction in parenthesis by a positive number), it was not always possible to find a suitable video. This as well as the need for some uniformity in the video environment led us to the idea of supplementing the chatbot with our own videos in the future.

Table 1: The topics of algebraic expressions

1	Introduction (welcome message and explanation)	14	Distributive property (multiplication of expressions in the form (a+b)(a+b)=a^2+2ab+b^2)
2	Distributive property (multiplying by positive number, addition in the brackets)	15	Product of two polynomials (using algebraic identity (a+b)(a-b)=a^2-b^2)
3	Distributive property (multiplying by positive number, subtraction in the brackets)	16	Product of two polynomials (using algebraic identity (a±b)=a^2±2ab+b^2)
4	Distributive property (multiplying by negative number)	17	Factoring out (a number)
5	Distributive property (combined)	18	Factoring out (variable)
6	Distributive property (with powers)	19	Factoring out (different variables)
7	Distributive property (with powers 2)	20	Factoring out (brackets)
8	Distributive property (multiplying by variable)	21	Factoring out (factorization of polynomial)
9	Distributive property (multiplying by variable of higher power)	22	Determining number of terms of polynomial
10	Distributive property (multiplying by product of several variables)	23	Polynomic addition and subtraction
11	Distributive property (several brackets with one variable multiplication)	24	Application of algebraic identities for factorization
12	Distributive property (several brackets with several variables multiplication)	25	Vieta's formulas
13	Distributive property (multiplication of expressions in the form (a+b)(a-b)=a^2-b^2)	26	Discriminant, search for roots of polynomial

4. Chatbot

The chatbot environment works like any other simple online chat. The conversation can be started online, but it can also be started in the Telegram mobile app. The Telegram application is available free of charge and the chatbot responds faster. The user communicates using simple commands that they select from pre-prepared options. Once started, the pupil has the opportunity to choose from several topics. If the pupil finds the unit easy and has already mastered it, they have the opportunity to skip it and continue with further units. If not, they can play an instructional video or start solving the tasks. After starting the section, the pupil has a choice

of two difficulty levels – easy and standard. Having completed them, they proceed in difficulty. If they do not wish to do so, they do not have to solve the difficult task. If the pupil does not know how to solve the task, in difficult tasks that are offered the opportunity to look at the sample solving procedure. In case of easy tasks, they are offered help and in standard tasks the pupil can choose whether to watch the instructional video or try the easier task. The options that are offered to the pupil at any time of the chat are shown in more detail in the diagram in Figure 1.

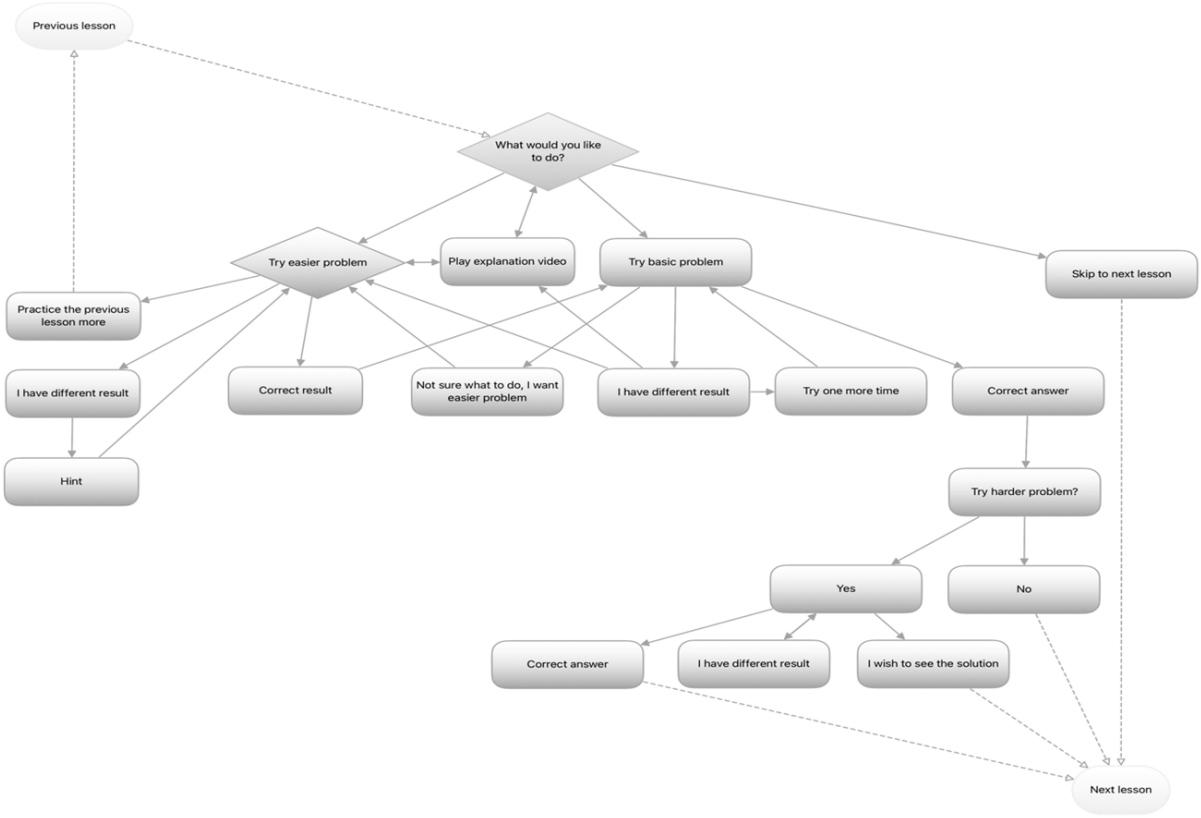

Figure 2: Individual topics of algebraic expressions

4.1 Selecting the answer

We did not choose the classic multiple choice offer for interaction with the pupil, but based it on the older principle of H. Kayen from the University of Sheffield. The pupil answers on his own, writes down the solution and then compares it with or identifies it in the offered answer. What is important in the decision-making processes in our application are the offered options “another answer” and “I don’t know”, which means the pupil is not obliged to choose one particular answer (Kulič, 1971). The absence of distractors puts the pupil in a situation where they see what answer they should expect, and so they can better direct their steps or make corrections to numerical mistakes, for example. We expect thus to approach to lower the level of pupil frustration at times when they are not be able to cope with the task. The non-traditional environment also aims at making a difference between tutoring, for which the application is designed, and the school approach to assessment. We realize that using only one correct answer can, in some cases, tempt pupils to just confirm the correct answer without having to solve their own tasks. That is why we closely monitor the time that has elapsed between entering a question and answer. Then we are able to detect skipping the solution phase on the basis of very short time intervals between entering a question and an answer.

4.2 Communication with chatbot

The impression of communication with a real person is enhanced by the presence of additional texts where the chatbot encourages, applauds but also communicates with them using a variety of funny pictures with popular film characters (Figure 2). Inclusion of these is intended primarily to motivate pupils to continue and finish the unit.

In order to increase pupils' motivation, a function has been integrated into the system, by means of which the chabot can, at least partially, respond to comments and remarks that are not directly related to the topic. This part was not created within the project. Conversation modules in English were used. The system thus translates the pupil's sentences into English, looking for suitable reactions to them, which again translates back into Czech. Thanks to high-quality tools for machine translations, the need to create a conversation module in Czech was circumvented, which would be very difficult due to the structure of Czech language.

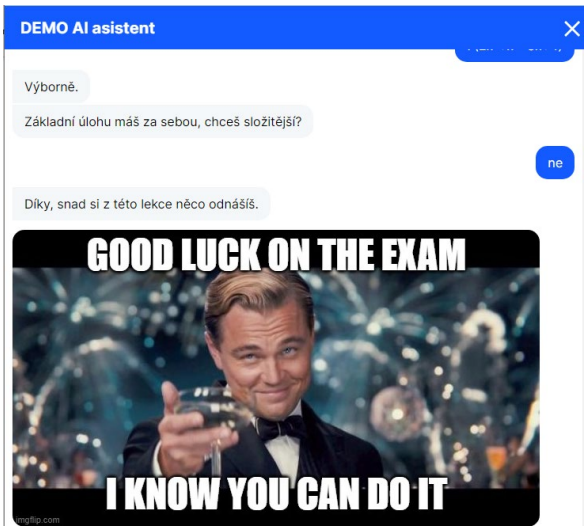

Figure 2: Illustration from the environment of the AI assistant

4.3 Web interface

The application in the web environment is activated using a code. Having logged on, the user gets an option thanks to which they do not have to start the course from the beginning but can directly access the topic that is interesting for them (Figure 3).

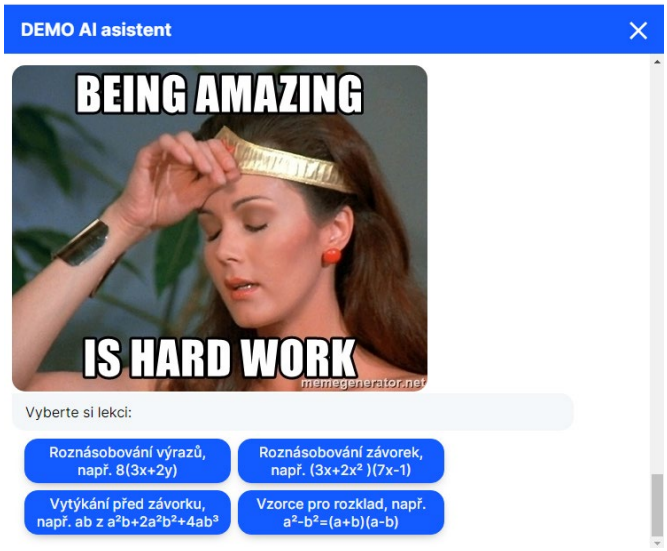

Figure 3: AI assistant – selecting a unit

Having selected the unit, the user continues following the procedure described in Chapter 3. Instead of the web environment, the user can use the application Telegram.

4.4 Telegram app

The application Telegram (Figure 4) is a freely available chat programme that has been repeatedly used in education, especially in teaching languages (Citrawati at al, 2021, Alakrash at al, 2020, Sari, 2017). The advantage of this environment is that is has been developed for mobiles. Thus, pupils can use it without any further obstacles. It comes out of the world of social networks that pupils use on everyday basis.

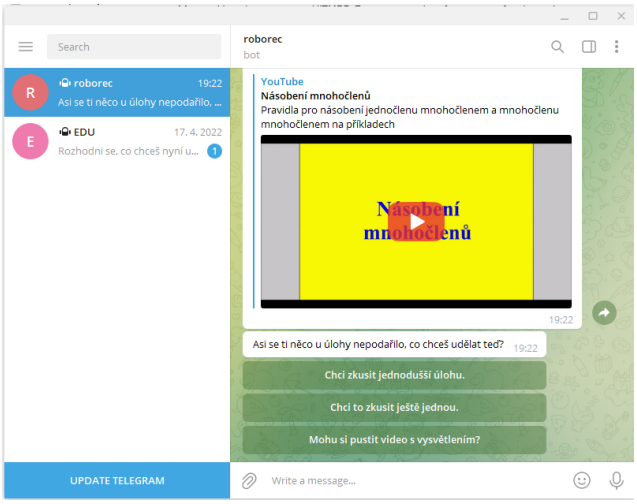

Figure 4: AI assistant – selecting a unit

5. Conclusion

The use of AI in education is a trend that aims to improve and make education accessible. Offering a suitable, inexpensive alternative to commercial tutoring is one of the ways of reducing the impact of socio-economic factors in education. The application, which we are developing as part of the research and which we presented in the article, tries to make tutoring accessible to all pupils.

The presented research is at its beginning. Among the most important issues that the research will focus on is the evaluation of the chosen strategy of not using distractors in solving tasks and the issue of further individualization of educational materials based on information about the learning progress of individual learners.

Acknowledgements

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References

Alakrash, H., Razak, N. and Bustan, E. (2020) The Effectiveness Of Employing Telegram Application In Teaching Vocabulary: A Quasai Experimental Study. *Multicultural Education*, Vol 6, No. 1.

Attard, A. E. (2021) *AI assisted pedagogical chatbot* (Bachelor's thesis, University of Malta).

Citrawati, N. K., Suwastini, N. K. A., Jayantini, I. G. A. S. R., Artini, N. N. and Dantes, G. R. (2021) Telegram as Social Networking Service (SNS) for enhancing students' English: A systematic review. *Journal of English Language Teaching and Linguistics*, Vol 6, No. 2, pp 239-260.

Kim, J., Merrill, K., Xu, K. and Sellnow, D. D. (2020) My teacher is a machine: Understanding students' perceptions of AI teaching assistants in online education. *International Journal of Human–Computer Interaction*, Vol 36, No. 20, pp 1902-1911.

Kubínová, M., Barešová, M. and Hanušová, J. (1999) How teachers' beliefs influence mathematical lessons? In A. Afzal, W. Honor, Kraemer, J.M. (Eds.), *Proceedings of CIEAEM 51*. Chichester: CIEAEM.

Kulič, V. (1971) *Chyba a učení*. Praha: SPN.

Linchevski, L. and Livneh, D. (1999). Structure sense: The relationship between algebraic and numerical contexts. *Educational Studies in Mathematics*, Vol 40, pp 173-196.

MacGregor, M. and Price, E. (1999) An exploration of aspects of language proficiency and algebraic learning. *Journal for Research in Mathematics Education*, Vol 30, No. 4, pp 449–467.

Rendl, M., Vondrová, N. et al. (2013). *Kritická místa matematiky na základní škole očima učitelů matematiky* (Critical Points in Mathematics at Elementary School through the Eyes of Teachers). Prague: Charles University, Faculty of Education.

Sari, F. M. (2017, November). Maximizing telegram application for teaching reading. In *UAD TEFL International Conference*, Vol. 1, pp. 228–233.

Stacey, K., Chick, H. and Kendal, M. (Eds.) (2004) The future of the teaching and learning of Algebra. *The 12th ICMI Study*. Boston / Dordrecht / New York / London: Kluwer Academic Publishers

Zawacki-Richter, O., Marín, V. I., Bond, M. and Gouverneur, F. (2019) Systematic review of research on artificial intelligence applications in higher education–where are the educators? *International Journal of Educational Technology in Higher Education*, Vol 16, No. 1, pp 1–27.

The Relationship Between Computer Gambling and Academic Performance of High School Students

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Abstract: While some sources say that playing video games has potential benefits whether in medicine or science, other sources take a different view and say that it can have various negative impacts. Video games are becoming more attractive thanks to their social, intellectual and emotional possibilities compared to television, movies or radio. The issue of gaming is increasingly discussed today mainly due to the large number of available platforms on which to play. Games are becoming more and more realistic both in terms of graphics and artificial intelligence. It is relatively difficult to avoid the influence of games with ever-improving mobile games or games on social networks. Playing games is no longer a home affair but it has become ubiquitous. All of these aspects can have a negative impact on pupils' welfare across all age groups and may pose a risk of possible addiction. The aim of this paper is to describe the impact of computer gambling on school performance. The subject of this study was a group of 138 high school students studying to be computer science teachers. In addition, the authors also examined the latest gaming trends of the current generation of high school students and possible manifestations of addiction to playing video games in this group of individuals. The research was carried out using a questionnaire survey, projective methods (word association experiment and incomplete sentence test) and analysis of school documents. The aim of the questionnaire survey was to determine the player preferences of the examined individuals and their subjective perception of their own playing of games. Projective methods were used to determine the affective responses of individuals to stimuli related to playing games. School documentation was a source of records of a particular student. The study's findings suggest a potential relationship between playing video games and academic performance of the individuals and the obvious signs of addiction in some of the individuals involved.

Keywords: video games, academic performance, projective testing, high school, addiction

1. Introduction

The number of smartphone users is growing all the time, with more and more users being permanently connected to the internet and often addicted to playing sophisticated games or social media. While some sources mention possible benefits of video games (Sauce et al., 2022; Holmes et al., 2009; Sanchez, 2012) in medicine or science, other sources present a different take on the issue, listing negative effects of gaming (Freeman, 2008; Kim et al., 2008). Due to ongoing technological advancements, video games are constantly increasing in quality, with their gameplay characteristics and visual aspect becoming ever more realistic. In this study, the term "video game" refers to any game that runs on a computer, mobile device or video game console.

A 2021 survey with 389 teenage respondents revealed that for the vast majority of them (76.9 %), the smartphone was the platform on which they played video games (Wan, Zakaria, & Zahurin, 2021). Compared to other media, such as television, movies or radio, video games are much more attractive thanks to their social, intellectual and emotional possibilities (Javanmard, Khaksari, & Yarahmadi, 2014). Games can be a way out of a situation with which an individual is not comfortable for some reason. The study argues that video games are an affordable way to create one's own world, i.e. to create a problem-free reality. This allows an individual to escape from reality to their very own, idealized world (Viktorovna Grishina & Nikolaevna Volkova, 2018).

Gambling addiction or pathological gaming is "repetitive gaming behavior despite harm or negative consequences, such as risking or losing significant relationships, or job, educational or career opportunities" (Hartl, 2012). Video game addiction is also characterized by losing interest in or reducing participation in other recreational activities, i.e. giving up one's favorite activities due to gaming. In the worst cases, an individual may even lose their friends or spouse due to gaming. According to Griffiths (2009), there are similarities between substance abuse and video game addiction, both of which can be described using the six core components of addiction. For the above reasons, the authors are interested in this issue, especially in how video game addiction can influence students' academic performance.

The main research question was formulated as follows:

- RQ 1: Can there be a relationship between the time students spend playing video games and their academic performance?

The authors also formulated two additional research questions, which may prove beneficial in determining the relationship between gamer characteristics and academic performance.

- RQ 2: Why do students play video games? What is their main reason?

The third research question is related to the time students spend playing video games. It was formulated as follows:

- RQ 3: How many students show symptoms of video game addiction?

To collect data needed, among other things, to answer the research questions, the authors used mixed methods research, which combines elements of qualitative and quantitative research, including projective techniques, questionnaire survey and written document analysis.

2. Methods

Data collection was divided into three phases which followed one another in fixed order, as can be seen in Figure 1. Incomplete sentence test was used first:

Figure 1: Sequence of research phases

The verbal projective technique of sentence completion was used in a 24-question e-questionnaire. The goal was for the participants to complete the sentences using the first idea that came to mind. Time for completion was set so that the participants did not have much time to think about their answers and spend too long on the individual items. Such a test requires a researcher to be present during the testing.

The word association experiment, which was also carried out electronically, consisted of eight items, with only one item being displayed at a time. This prevented the participants from taking previous and/or following items into account, thus allowing them to focus on the current question. The participants had 60 seconds to complete each item. Then they had to proceed to the next one. The researcher instructed the participants to try and come up with as many words or ideas related to the listed word as possible.

A questionnaire survey was used that included 27 questions, some of which required a guess on the part of the participants. Since those were questions with a low significance level, they were modified from open-ended questions to multiple choice questions (the student had to choose one of a variety of categories).

To be able to answer the research questions, the authors needed to put the data collected through the questionnaire survey and the existing records of students' academic performance into context, focusing on their grades in the first semester of the 2021/2022 academic year. Each participant was assigned a value that was calculated as the arithmetic average of all their grades (all subjects) over the monitored period.

The main part of the research project took place at High School of Computer Science in Ostrava in December 2021. The school offers two study programs, with each divided into two classrooms. As a result, as many as 480 students can attend the school; there are 16 classrooms over 4 grades. The first study program is Information Technology and the second is Information and Communications Technology. Both study programs share the same basic concepts and theoretical and practical background, with the specifics being different.

127 students participated in the main part of the research project at High School of Computer Science in Ostrava.

3. Data analysis

3.1 Relationship between academic performance and time spent playing video games

The questionnaire included an item designed to determine time spent playing video games; the respondents were asked to choose one of seven options (from less than 1 hour to more than 6 hours). The respondents' answers are presented in Figure 2. It is obvious that the majority of students spend 2 to 4 hours a day on average playing video games. One-fourth of students spend even more time a day playing video games. The authors analyzed school documents in order to obtain records of students' academic performance across all subjects; these are presented in the table below.

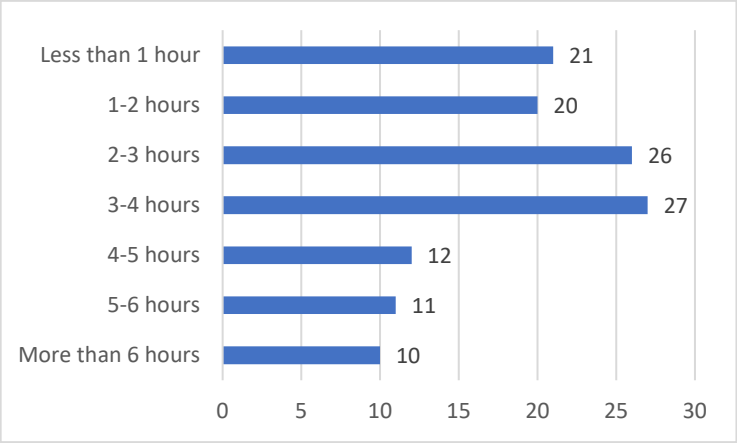

Figure 2: Time spent playing video games a day

Table 1: Data characteristics

	N	Min.	Max.	Avg.	SD	Median
Time spent playing video games	127	1*	7*	3.488	1.799	3
Academic performance	127	1.12	3.15	2.002	0.472	1.19

*) These are not real values but rather the order of choice, as seen in Figure 2

Pearson's correlation coefficient was applied to determine the relationship between the average time spent playing video games a day and students' academic performance. Based on the processed data, the coefficient reached the value of 0.22285. The calculated p-value = 0.011792 was below the significance level ($\alpha = 0.05$).

3.2 Reason for playing video games

Considering the research focus, it was appropriate to ask students why they play video games in the first place. What is their main reason for playing them? Data for answering this question were collected through questionnaire item No. 20, and are presented in a table which is attached as Attachment 6. The data layout is presented in Figure 3. Results show that the main reason why students play video games is to escape reality. The second most frequent reason was boredom, which is an opportunity for organizations providing sports and leisure activities for children and youth. This was followed by the desire to make new friends, which proves that online multiplayer games hold a significant position in the market, as it is only during these kinds of games that new friendships and relationships can be made. The chart also shows that overcoming challenges or games' gameplay characteristics are not significant factors determining the respondents' interest in a particular game.

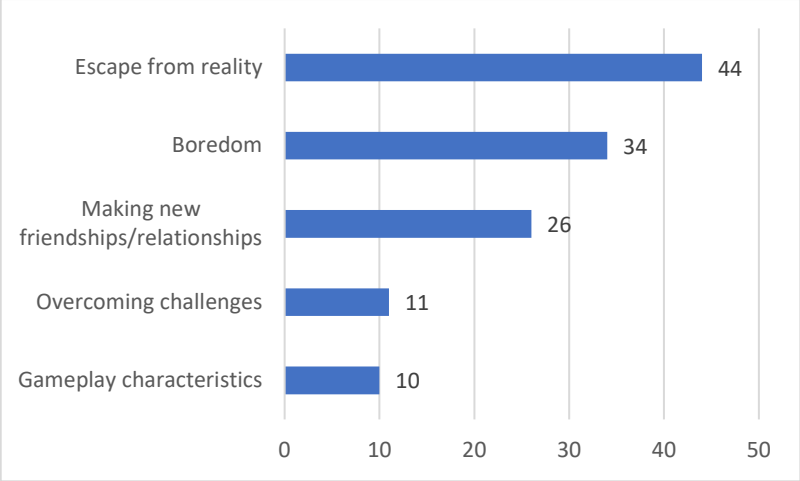

Figure 3: Reasons for playing video games

3.3 Addiction signs and symptoms

Selected questionnaire items were focused on addiction signs. They were designed as either multiple choice questions or Likert Scale questions. Situations or signs that the majority of addictions have in common were used in the questions. The questions were as follows:

- How many times over the past 6 months have you spent an entire day playing video games?
- When I am unable to play video games for a long time, I feel bad.
- When I am unable to play video games for a long time, I become angry.
- I become annoyed when I plan to play video games but cannot due to lack of time.
- Sometimes I argue with my parents about the amount of time I spend playing video games.
- Sometimes I do not have time for my family or friends due to gaming.
- Sometimes I do not have time for my school assignments or other chores due to gaming.
- I have been spending a lot more time playing video games than I used to.
- Sometimes I end up playing video games for much longer than I originally intended to.
- Over the past 6 months, I have not been able to reduce the amount of time I spend playing video games.
- Over the past 6 months, someone has unsuccessfully tried to persuade me to reduce the amount of time I spend playing video games.

A quantitative method was used for data processing, during which the answers were encoded and the final score was compiled. The maximum achievable score was 34 points. There were 16 respondents who gained 18 or more points. Selected individuals answered more than half of the addiction-related questions affirmatively, which should be considered as a warning signal. The following figure (Figure 4) shows the individuals who answered more than half of the addiction-related questions affirmatively. These respondents were also asked about their preferred video game genre. It was determined than 10 of them preferred action games, 5 of them preferred RPG games and 1 was a fan of simulation games.

In the final part of the questionnaire, the respondents were asked about their attitudes toward video games (Figure 5). The respondents were informed that the statements included in the items did not have to apply to them only, but they were common facts that could also be applicable to other persons. Judging by the prevailing answers, it is safe to say that the majority of respondents (67.4 %) did not agree with the statement that video games lead to drug experimentation. Furthermore, the majority of respondents (49.3 %) did not agree with the statement that in video games violence is a common problem-solving strategy. The majority of respondents also rather agreed with the statement that video games helped expand general knowledge (54.3 %) and improve concentration (54.3 %). The respondents also agreed that video games could help expand one's vocabulary (55.1 %), expand one's circle of friends (48.6 %) and improve one's social skills (46.4 %).

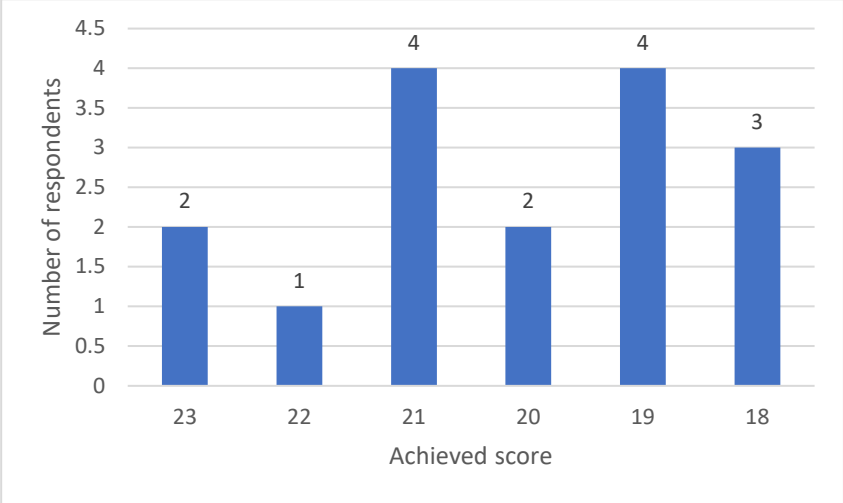

Figure 4: Respondents who showed symptoms of addiction

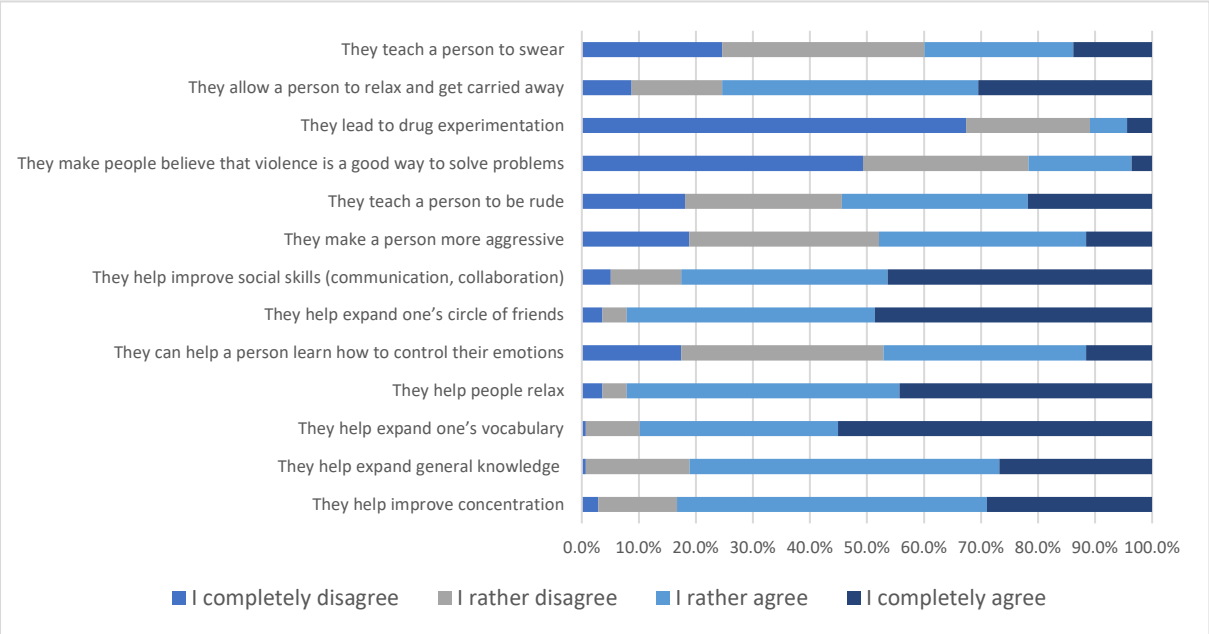

Figure 5: Respondents' attitudes toward video games

The following can be deduced from the results of a projective test composed of an incomplete sentence test and a word association experiment:

- In the examined sample of students, individuals most often play video games because they are bored.
- Students often play video games at home.
- The students also stated that they used their phone or computer/laptop mostly for games and entertainment. Searching for information and school preparation were the least frequent answers.

4. Discussion

Analysis of the collected data provided answers to the research questions.

RQ 1: The amount of time spent playing video games has a minimal effect on students' academic performance (the results showed a statistically insignificant relationship). Compared to other published studies (Wright (2011) or Anand (2007), however, the authors' results are not as clear. Since the survey was focused on high school students, who are used to playing video games, one can assume that they can divide their time between school preparation and playing video games (Drummond and Sauer, 2014).

However, there are studies where playing video games had a positive effect on students' academic **performance (Kovess-Masfety et al., 2016; Sauce et al., 2022).**

RQ 2: Among the reasons for playing video games listed by the participating students were: to escape reality, to escape boredom or because they consider playing video games to be a social event. These findings correspond to those found in published studies. In the majority of cases, the time spent playing video games can be viewed as procrastination. However, according to Nodby et al. (2019) , no such relationship has been confirmed. Therefore, students can have different reasons for playing video games.

RQ 3: Video game addiction is a wide topic. This study used a questionnaire survey and the aforementioned questions to ask students whether or not they thought they had their gaming under control. Using the aforementioned methodology, the authors were able to identify 16 students whose answers showed signs of video game addiction. The collected data confirm the results of the Novrialdy et al. study (2019), which argues that the majority of high school students are well aware of the risks posed by video games and therefore try to avoid them. Block (2008) uses a different methodology for measuring video game addiction, focusing on the amount of time spent playing video games. Having analyzed his data, Block (2008) concluded that students who spend 23 hours a week playing video games are likely to develop an addiction. Time spent gaming can therefore be a sign of addiction. At the same time, students with low socioeconomic status are more likely to become addicted to video games than others (Muezzin, 2015).

The presented results are not applicable to all high school students. This study is limited by its narrow focus – all the participants were computer science students who may have a better understanding of the issue and thus approach it differently than humanities students. However, the authors were able to prove that computer science students can be resistant to video game addiction.

5. Conclusion

The goal of this study was to determine whether playing video games had an effect on students' academic performance. The study was aimed at high school students, specifically computer science ones. The authors' findings prove that the amount of time spent playing video games has an effect, albeit a small one, on students' academic performance. Furthermore, playing video games is no longer a predominantly at-home activity; a large number of students stated that apart from their computer, they also used their smartphone to play video games. For students playing video games is a way to relax or a leisure activity. The question is whether or not students would play video games even if they had less free time. The authors intend to continue their research, focusing on the effect of video games on other target groups, the relationship between video games and the amount of knowledge and skills, as well as the effect of educational video games.

References

Anand, V. (2007) "A Study of Time Management: The Correlation between Video Game Usage and Academic Performance Markers", *CyberPsychology & Behavior* Vol 10, No.4, pp 552-559.

Drummond, A., Sauer, J. D. and Chambers, Ch. (2014) "Video-Games Do Not Negatively Impact Adolescent Academic Performance in Science, Mathematics or Reading", PLoS ONE, Vol 9, No. 4.

Freeman, C. B. (2008) "Internet gaming addiction", *The Journal for Nurse Practitioners*, Vol 4, No. 1, pp 42-47.

Griffiths, M. (2009) "A 'components' model of addiction within a biopsychosocial framework", *Journal of Substance Use*. Vol. 10, No. 4, pp 191-197.

Grishina, G. A. and Volkova, E. N. (2018) "Psychological Factors for Computer Game Addiction of Young Adolescents", International Journal of Engineering & Technology. Vol 7 No. 3.14, pp 327-330.

Hartl, P. (2012) *Stručný psychologický slovník*, Portal, Prague.

Holmes, J, Gathercole, S.E. and Dunning, D.L. (2009) "Adaptive training leads to sustained enhancement of poor working memory in children", *Dev Sci*., Vol 12, No. 4, pp F9-15.

Javanmard, M., Khaksari, Z., and Yarahmadi, J. (2014) "Computer Game and Psychological Motivation of Adolescents", *AENSI Journals*, Vol. 8, No. 10, pp 119-125.

Kim, J. E., Namkoong, K., Ku, T. and Kim, S. J. (2008) "The relationship between online game addiction and aggression, self-control and narcissistic personality traits", *European Psychiatry*, Vol. 23, No. 3, pp 212-218.

Kovess-Masfety, V., Keyes, K., Hamilton, A., Hanson, G., Bitfoi, A., Golitz, D., Koç, C., Kuijpers, R., Lesinskiene, S., Mihova, Z., Otten, R., Fermanian, C. and Pez, O. (2016) "Is time spent playing video games associated with mental health, cognitive and social skills in young children?", *Soc Psychiatry Psychiatr Epidemiol,* Vol 51, (3):349-57. doi: 10.1007/s00127-016-1179-6. Epub 2016 Feb 5. PMID: 26846228; PMCID: PMC4814321.

Muezzin, E. (2015) " Comparison of Online Game Addiction in High School Students with Habitual Computer Use and Online Gaming", *Turkish Online Journal of Educational Technology*, Vol 2, pp 59-65.

Nordby, K., Løkken, R.A. and Pfuhl, G. (2019) "Playing a video game is more than mere procrastination", BMC Psychol, Vol 7, No. 33.

Sanchez, Ch. A. (2012) "Enhancing visuospatial performance through video game training to increase learning in visuospatial science domains", Psychonomic Bulletin & Review, Vol 19, No. 1, pp 58-65.

Sauce, B., Liebherr M., Judd N. and Klingberg T. (2022) "The impact of digital media on children´s inteligence while controlling for genetic differences in cognition and socioeconomic background", *Scientific Reports*, Vol 12, No. 1.

Wan Y., Zakaria, N. H., and Mat Aji, Z. (2021) "Identification of factors contributing to the online game addiction among adolescents", *Journal of Information and Communication Technology*, Vol. 20, No. 4, pp 565-597.

Wright, J. (2011) "The effects of video game play on academic performance", *Modern Psychological Studies.* Vol 17, No. 1, Article 6.

Supporting Learning Mobility With Student Data Harmonisation: A European Perspective

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Abstract: Digitalisation promotes online education, internationalisation and student mobility. Based on the Bologna process and the European higher education area, learning mobility has been successful under Erasmus and other similar initiatives. However, a key issue for students and universities is that a significant amount of time is spent on the manual labour involved in the process of applying to degree programs overseas. It is therefore essential for higher education institutions to better exploit the potential of technology and Web 2.0 to enable a secure exchange of evidence during application for degree programs and academic courses in foreign Higher Education Institutions, as well as applying for study grants and obtaining recognition for academic and other types of studies. Harmonisation of the student data is a key initial step for enabling such exchange. In this study, an approach to a secured exchange of education evidence is instrumented under the H2020 project Digital Europe for All (DE4A). Existing semantic standards for Web 2.0 applications, core vocabularies for public service data and semantic assets from existing best practices such as W3C, ISA2 core vocabularies, and Europass data model are used to curate data models that allow the exchange of a higher education diploma, secondary education diploma and information of special needs (disability, large family), which is required by students when requesting study grants (waive of tuition fees). The semantic interoperability agreements are established cross-border through these data models called canonical evidences. The canonical evidences are tested with the national data services of three countries, Portugal, Slovenia, and Spain. The final data models are implemented in XML Schema format that could be used by any educational organisation intending to use trusted public service databases within Europe to automatically retrieve information on students' degrees. The validity of the canonical evidences is tested on two pilot occasions within the DE4A project. The outcome of this study summarises the procedural requirements for evidences when applying for a higher degree program and seeking grants. Furthermore, it resulted in verified canonical evidence data models that fulfil the procedural requirements for applying for studying abroad.

Keywords: learning mobility, semantic interoperability, data harmonisation, higher education, cross-border

1. Introduction

Student internal (within the resident country) and external (outside the resident county) mobility has become pervasive under flexible education provisions in the digital age (Choudaha and Chang 2012; Joint Research Centre (European Commission) et al. 2015; Rivza and Teichler 2007). Digitalisation of the education sector paves the way forward for universities to introduce student exchange programs and mix-and-match education allowing personalisation and individualised education (Borghetti and Beaven 2017; Hefler and Steinheimer 2020). For instance (Rivza and Teichler 2007) describe four varieties of student mobility; 1) In search of unique specialisation programs offered by reputed universities and scholars, 2) Program/s in a neighbouring country to experience a change with relatively low risk of cultural or language differences, 3) Taking a term or two of a program in another country that has a similar level of education/reputation, and, 4) University motives for attracting international students for diversity and financial reasons. The trends of students expanding their education within and among their higher education programs can only be increased in the future (Choudaha and Chang 2012; Hefler and Steinheimer 2020; Joint Research Centre (European Commission) et al. 2015). To deal with this emerging trend and its consequences, and to allow smoother and more efficient student mobilisation, many global and regional programs have been introduced in the past. For example, EU's ERASMUS and ERASMUS+ programs support students financially and academically to study abroad by providing education exchange platforms ('Home | Erasmus+' n.d.). This possibility of mixing and matching education programs and courses from different universities in different countries is enhanced by standardising the educational qualifications by the Bologna process, which is "*a process aimed at ensuring comparability in the standards and quality of higher-education qualifications*" ('Bologna Process - University of Bologna' n.d.). This initiative has successfully harmonised the academic qualifications at least across Europe. The European Higher Education Area (EHEA) brings together "*49 countries with different political, cultural and academic traditions, which, step by step during the last twenty years, built an area implementing a common set of commitments: structural reforms and shared tools*", with educational reforms that support the higher education systems, increasing student and staff mobility ('Higher Education | European Education Area' n.d.). These initiatives justify the EU's growth strategy for the coming decade that highlights higher education as a key policy area where collaboration

between the EU and the Member States can deliver positive results for jobs and economic development through quality education ('Bologna Process - University of Bologna' n.d.; 'Higher Education | European Education Area' n.d.).

Typical higher education provision has two stages, application to programs by students and selection process by the university. From this, digitalisation of the application process is something that is considered under the digital Europe programs ('Higher Education | European Education Area' n.d.). The reason is, however, that a major issue for students and universities in this regard is that a significant amount of time and cost is spent on the manual labour involved in the process of applying to degree programs overseas. It is a key policy issue for the Member States and higher education institutions to "*better exploit the potential of ICTs to enable secure exchange of evidence for the registration in foreign Higher Education Institutions*", as well as applying for study grants and obtaining recognition for academic and other types of studies.

A key requirement for cross-border education services (registration for foreign degree programs) is the interoperability of the services led by the harmonisation of student information (data) (DE4A Consortium 2022). The process of cross-border information exchange entails an absolute necessity, which is the semantic agreements of the data to be exchanged across-borders that each EU member state can agree on in connection with the welcoming of foreign students in their countries. It is therefore essential for higher education institutions to better exploit the potential of technology and Web 2.0 to enable secure exchange of evidence to enable their current and former students to register for education activities in foreign Higher Education Institutions, as well as to apply for study grants and obtain recognition for academic and other types of studies. Harmonization of the student data (the semantics) is a key initial step for the exchange. With the aim to enable higher educational institutions to offer the possibility of their students to apply for degree programs in foreign public higher educational institutions, this study instruments an artefact addressing the following research questions: 1) What are the procedural requirements for degree programs when students apply from a different country of residence in the EU?, and, 2) How can harmonised and standardised data models enabling the secure student information exchange across borders be developed based on the existing semantic standards for Web 2.0 applications (W3C n.d.), core vocabularies for public service data ('Homepage | ISA^{2}' n.d.) and semantic assets from existing best practices such as the Europass data model (Europass n.d.)? In answering the research questions, the partnerships under a European commission Horizon 2020 project named Digital Europe for All (DE4A) (DE4A 2020) are utilized for increasing the impact of the research outcomes and ensured validation and applicability of the developed artefacts.

The rest of the article is organized as follows. The next section provides the context and background of this research work. Section 3 briefs about the methodological approach followed. Section 4 illustrates how the data models are developed based on the elicited requirements, and finally, the concluding remarks section summarizes the funding of this work and some promising further work.

2. Background

Interoperability of education services depends heavily on the similarity of education data both in usage and in concept or meaning (Berberidos et al. 2020). In other words, respective public authorities that are responsible for education offering (the foreign university student wish to register for) on one end, as well as credentialization of education (the university student received pre-requisite qualifications) on the other end, should speak the same language for effective information (data) exchange. The prerequisites for registering for a degree program may depend on the subject area, university, country and the type of the qualifications, which may be granular questions to be overseen by a qualified administrator in the university. For example, when referencing data of student's domicile, Country A, where the student resides, may use a concept of "address" as a "structured object" while Country B, where the student is going to apply for a university, may just allow presenting the address as a "text field". When such different formats of data are being exchanged between countries A and B, a prior understanding of the data type is extremely important, viz, the data should be interoperable. Such an understanding – mapping – of data is demanding under both technical and legal grounds of educational services provided through public procedures. Data harmonization, i.e., one-to-one mapping of data at both sending and receiving countries has many bottlenecks, of which, the agreement between the two authorities (in two countries in the cross-border case), is the narrowest among them (DE4A Consortium 2022). When referring to interoperability, the first step is to identify, which pieces of data are required by the procedure for obtaining foreign higher education. According to the single digital gateway regulation (EC n.d.), this data set should be the

minimal information needed to prove the previous education and other data required to execute the said public procedure. In this article, such a data set is defined as "A collection of data, published or curated by a single agent (Data Providing authority), and available for access in one or more representations."(DE4A Consortium 2022).

2.1 Canonical evidence for interoperability

In the European Union Horizon 2020 project of Digital Europe for all (DE4A 2020), interoperability is achieved through an "*Evidence, which is a Dataset required to prove a Requirement or Criterion*"(DE4A Consortium 2022). In the public administration context, evidence is the information to legally prove that procedural requirements are met. This could be "*any document or data, including text or sound, visual or audio-visual recording, irrespective of the medium used, required by a competent authority to prove facts or compliance with procedural requirements referred to Article 2.2.b(SDGR)"* (Berberidos et al. 2020). In the traditional form of registering for degree programs at universities, the students manually produce the required documents (evidence) when they fill in the application forms. Digitalised public service intends to reduce the administrative burden of this inefficient process and increase the efficiency by providing all the evidence required by a procedure automatically from the accredited public agent, lawfully issued, even if it is cross-border. In this context, It involves electronic evidence which is "*Lawfully issued evidence by competent authorities ranging from completely unstructured formats (such as pdf or picture formats) to structured databases*"(Berberidos et al. 2020). As mentioned before, the agreement between the issuing and the receiving authorities on which data are required and can be provided by the agencies involved is the primary concern, which needs to be already solved prior to the execution of the procedure and enabling the online registration service. This agreement is established in the DE4A context by the concept of canonical evidence. By definition, canonical evidence is a "*Structured data model that includes a common set of attributes associated with the evidence type that can be provided by the corresponding lawfully issued evidences*". Hence it is essential to define canonical evidences for every piece of information required by public service procedures if they intend to provide the public service in Europe under the Single Digital Gateway Regulation (SDGR) (EC n.d.).

2.2 Web 2.0 for student data exchange

Defining the concepts and meaning for pieces of information is a major part of semantics. With the evolution of the Semantic Web, the technologies around it were gradually developed and reached a hype with the establishment of the World Wide Web Consortium - W3C (W3C n.d.), aiming at providing harmonization in the construction of the World Wide Web services. To date, the baseline for any resource, service, or action that is hosted through the web follows the W3C guidelines, definitions, vocabularies, and other respective technical resources required to set up any web service. Under the EU initiatives for digitalization of public services, and the once-only principle that entails "*The public administrations should ensure that citizens and business can supply the same information only once to a public administration and administrations should be able to retrieve and share this data to serve the user, in accordance with data protection rules."*(Berberidos et al. 2020), an administrative web portal service has become the main component (e-Delivery), that "*helps public administrations to exchange electronic data and documents with other public administrations, businesses and citizens, in an interoperable, secure, reliable and trusted way*".

According to SDGR, it is every EU member state's responsibility to contribute to a single digital gateway by establishing their procedure portals and thereby connecting their public services with the rest of the EU. In dealing with such a requirement, semantic interoperability of the evidence exchange system is a must. W3C provides the baseline for this semantic interoperability. Through many initiatives, the EU has also been trying to establish the semantic interoperability for the once only technical system, such as ISA and ISA^2 ('Homepage | ISA^2' n.d.), to help its member states create this "*common language for the European public administrations, so that information can be exchanged easily*"(DE4A Consortium 2022). For the academic domain, the most interesting development in this line would be the Europass data model (Europass n.d.). The Europass Digital Credentials Infrastructure (EDCI) is a set of standards, services and software that permits institutions to issue digital, tamper-proof qualifications and other learning credentials within the European Education Area. This data model is an extension of the W3C Verifiable Credentials Data Model (DE4A Consortium 2020a). EDCI streamlines the issuing, viewing and automatic verification of credentials and benefits a wide range of stakeholders, including individuals, universities, vocational training providers and employers. The infrastructure can guarantee a common understanding of qualifications and types of certifications across and beyond the European Union

(Berberidos et al. 2020). The infrastructure can also enhance transparency and portability of qualifications and skills between countries, reduce the administrative burden for citizens, learning providers and employers, make tampering and credential fraud easily identifiable, empower people to own and control their own credentials, and contribute towards digitisation of government processes. The Europass data model can constitute the basis for describing the concepts of higher and secondary education while providing the necessary credentials for certifying the evidences related to the domain of education. It should be noted that this paper describes semantic models for lawfully providing evidences for proving the educational qualifications at secondary and tertiary levels. Harmonising the pre-requisites for each and every higher education program in the universities in Europe is hence out of the scope of the EU Digital Europe program and this study.

3. Design and development methodology

The research questions urge a deeper investigation of the requirements for enrolment of students in a university in a foreign country, that complies with both the business situation and the legal agreement. Hence, a case is carefully chosen to allow specified scenarios to be used to study the case. A design science approach (Peffers et al. 2007) is followed as the overarching methodology of this research, which binds each of the steps in the artefact development process, i.e., the steps of the stages of the scenarios in the use case.

3.1 Use cases

In this study the use cases (UC1 &2) that are interconnected in applying for studying abroad were considered. These use cases were piloted in Portugal, Slovenia, and Spain. The pilots aimed to "*prove the optimal process/procedure for students from the three participating Member States for registration to higher education and eventually applying for a student grant as well as for studies recognition*" (DE4A Consortium 2020a).

UC1 - Application to Public Higher Education focuses on the Administrative Procedure of submitting an initial application for admission to a public tertiary education institution. This UC counts on the facilitation of electronic and physical mobility of (Erasmus/Erasmus+) students between Higher Education Institutions across Europe ('Home | Erasmus+' n.d.). The goal is to enable foreign students to get access, in a digital-by-default and once-only manner (Piswanger, Helger, and John 2019), with secure and GDPR-compliant consent-based exchange of electronic evidence), to register, enrol, or admit fully online and remotely using a trusted cross-border authentication such as CED eID (EUR-Lex 2014). The administrative procedures are traditionally burdensome in terms of time and human resources and students can be discouraged to apply by the complexity of procedures (DE4A Consortium 2020a). The solution for this use case requires the specification of semantically interoperable electronic evidence information structures including information on ECTS credits and exchange of simple academic attributes as needed by the participating universities in the role of the data providers, e.g., considering Europass (Europass n.d.) data model standard, to maximize replicability and scalability of results to other European countries, with due consideration of existing national workflows (involving directly the Higher Education Institutions and, where relevant, also regional or national Higher Education IT systems relevant for the enrolment of students), as well as on-going initiatives seeking interoperability or inter-linking of government and education identities (DE4A Consortium 2020a).

UC2 - Applying for Study Grant: Oftentimes students apply for a study grant from a public institution in conjunction with the application for degree programs. If the applicant wishes to obtain a study grant, the admissions office/ competent authority would likely ask for proof of their identity for cross-border remote authentication, proof of their grades, and their financial situation. If, having checked this information, the admissions office or the responsible competent authority finds it suitable, they might issue a certificate attesting that the person qualifies for a study grant (DE4A Consortium 2020a).

3.2 The design science research methodology for modelling the process

Based on the underlying need in the three UCs, a systematic process is required for the development of the required artefacts, which, as mentioned above, could be found in the premise of the DSRM process (Peffers et al. 2007). Figure 1 illustrates the design science application in this study.

Accordingly, the problem explication and the requirement elicitation are conducted together with the education stakeholders, i.e., university administration (student registration authorities), policy makers, semantic experts, legal advisers, officials in public service digitalization bureaus of selected countries, and students. The initial

requirement set drawn is co-created together with the stakeholders. The designed artefacts are regularly tested with the participants of the use cases described in section 3.1. These tests are conducted to canonical evidence models are evaluated within the public administration (Universities) of the said Member states using real students.

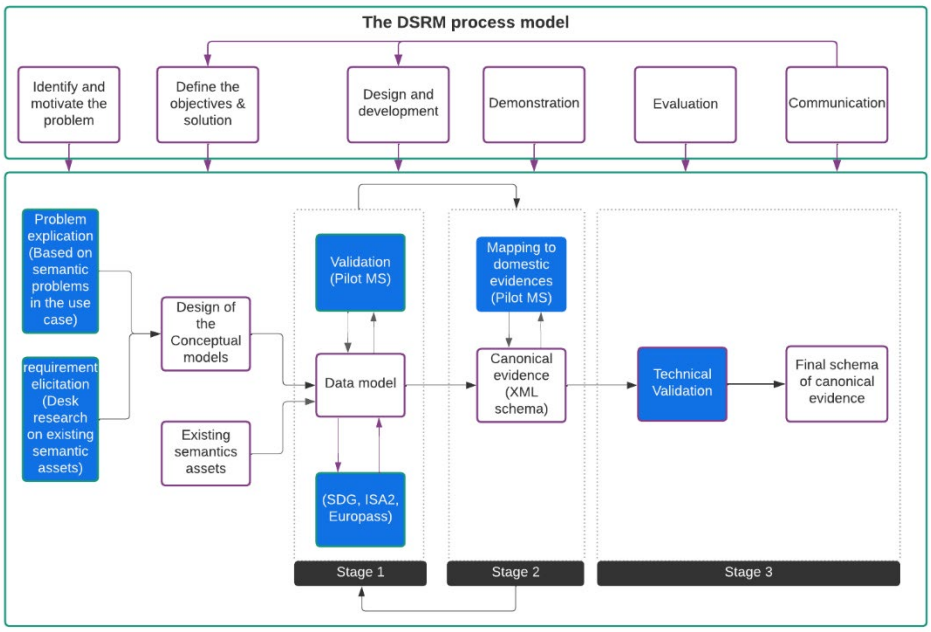

Figure 1: Design science application on a case study for artefact development

3.3 Ethical implications of the design and evaluation of the artefacts

The cross-border application for university studies requires the exchange of data that may include sensitive information as well (DE4A Consortium 2020b). However, in this research, we focus on developing only the metadata models (canonical evidence) that can be agreed upon between the university student registering themselves and the responsible competent authority of students' prior education certificates. However, the privacy of the stakeholders involved in the DSRM process is preserved according to the General Data Protection Regulation – GDPR ('Data Protection Impact Assessment (DPIA)' 2018).

4. Results and design outcomes

Based on the above, this section presents the implemented canonical evidence schemas for representing (a) a higher education diploma, (b) a secondary education diploma, and (c) information on special needs (disability, large family), which are required when requesting study grants (waive of tuition fees). The functional requirements underlying the implemented schemas were suggested by the DE4A pilot partners during regular consulting sessions in a co-creative and "agile" fashion that involved frequent iterations. An overarching horizontal requirement was that all canonical evidence models should rely on existing data exchange standards and should reuse existing models and controlled lists (i.e., code lists) as much as possible. All the schemas are available at the respective DE4A GitHub repository: https://github.com/de4a-wp3/study_abroad.

4.1 Higher education diploma evidence

This type of evidence proves that an individual has acquired a higher education diploma and encompasses all pertinent aspects for submitting an initial application for admission to a public tertiary education institution. This model largely adopted EDCI (Europass n.d.) for representing education-related concepts, and CBC (Common Basic Components) of the OASIS specification for the Universal Business Language v2.0 (UBL 2019) for representing temporal aspects, like, e.g., dates and durations. A diagrammatic overview of the higher education diploma model is illustrated in Figure 2 while Table 1 gives a more detailed specification of the attributes.

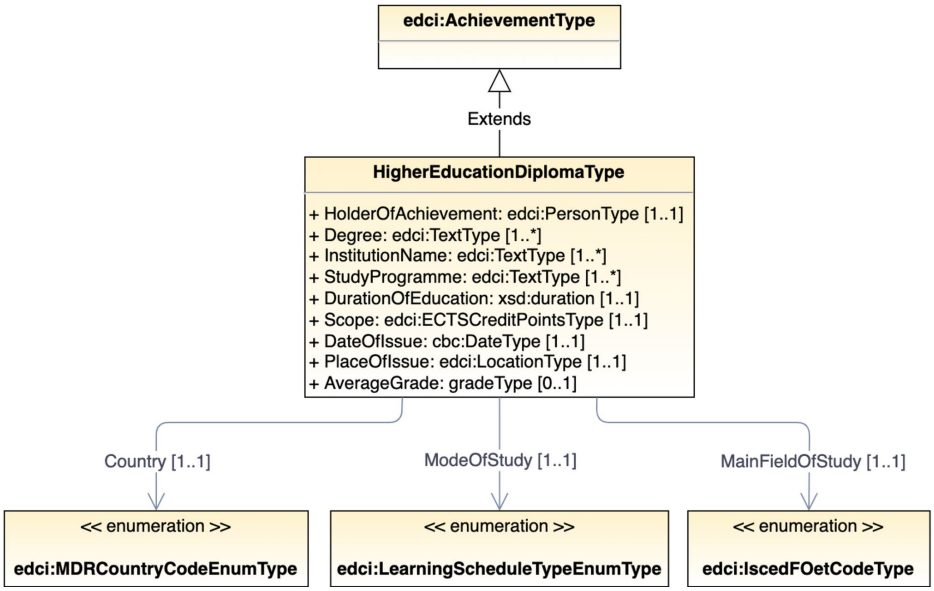

Figure 2: Higher education diploma evidence diagrammatic overview

Table 1: Higher education diploma evidence attributes specification

Field	Data type	Definition
HolderOfAchievement	edci:PersonType	Person that has obtained the academic title or degree.
Country	edci:MDRCountryCodeEnumType	Country where the study programme was completed by the student. Assumes values from the Country Authority Table codelist (EU publication office n.d.).
InstitutionName	edci:TextType	The name of the higher education institution where the student obtained the degree.
MainFieldOfStudy	edci:IscedFOetCodeType	Field of finished higher education. Assumes values from the ISCED-F controlled list (EU publication office n.d.)
StudyProgramme	edci:TextType	Name of a study programme that the student finished at the higher education institution in order to obtain the degree.
Degree	edci:TextType	An academic title or degree obtained by the student and proven by this diploma or certificate.
DateOfIssue	cbc:DateType	Date of issue of the certificate or diploma.
PlaceOfIssue	edci:LocationType	Place of issue (location) of the certificate or diploma.
DurationOfEducation	xsd:duration	Official duration of education.
ModeOfStudy	edci:LearningScheduleTypeEnumType	Mode of study, e.g., full-time, part-time etc. Assumes values from the Europass Standard List of Learning Schedule Types (EU publication office n.d.)
Scope	edci:ECTSCreditPointsType	The official workload of the study programme in ECTS credit points.
AverageGrade	Custom type	The average grade awarded. Extension to edci:TextScoreType, allowing representing the actual score grade, the grading scheme, along with a short textual explanation.

4.2 Secondary education completion evidence

As its name implies, the second type of evidence proves that an individual has completed their secondary education. Similar to the Higher Education Diploma Evidence, this type also largely relies on EDCI and CBC/OASIS, as also illustrated in the diagrammatic overview (Figure 3) and the attributes specification (Table 2).

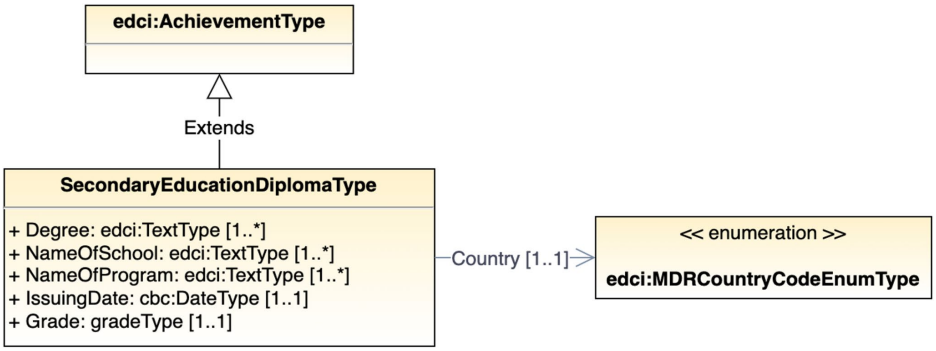

Figure 3: Secondary education completion evidence diagrammatic overview

Table 2: Secondary education completion evidence attributes specification

Field	Data type	Definition
Country	edci:MDRCountryCode EnumType	Country of completed secondary education. Assumes values from the Country Authority Table codelist.
Degree	edci:TextType	Degree previously obtained (e.g. General upper secondary education).
NameOfSchool	edci:TextType	Name of a secondary school that the person finished.
NameOfProgram	edci:TextType	Name of a secondary school programme that a person successfully finished (e.g. General secondary programme).
IssuingDate	cbc:DateType	Issuing date of the accomplishment.
Grade	Custom type	Mark indicating a degree of accomplishment. Custom type, same as AverageGrade above.

4.3 Non-Academic information evidence

In order to represent non-academic information (e.g., for the purposes of awarding a scholarship or grant), we introduce two canonical evidence types, DisabilityCertificateType and LargeFamilyCertificateType, which correspond to the respective certificates for proving a disability and a large family, respectively. As seen in Figure 4 and Table 3, both certificate types share a similar structure.

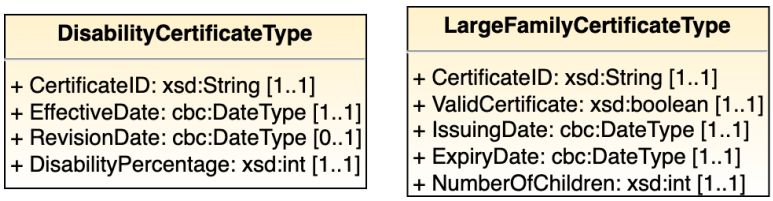

Figure 4: Diagrammatic overview of disability and large family certificate evidence types

Table 3: Disability and large family certificate attribute specification

Field	Data type	Definition
CertificateID (both types)	xsd:string	ID of the certificate.
EffectiveDate (Disability)	cbc:DateType	Date from which the disability certificate is valid.
RevisionDate (Disability)	cbc:DateType	Date on which the disability certificate will be reviewed.
DisabilityPercentage (Disability)	xsd:int	Specifies the degree of disability of the beneficiary. Indicated as a percentage.
ValidCertificate (LargeFamily)	xsd:boolean	True/false depending on whether the large family certificate is valid or not.
IssuingDate (LargeFamily)	cbc:DateType	Date of issue of the large family certificate.
ExpiryDate (LargeFamily)	cbc:DateType	Expiry date of the large family certificate.
NumberOfChildren (LargeFamily)	xsd:int	Indicates the number of children the holder of the large family title has.

5. Discussion and concluding remarks

The verified data models (canonical evidences) created in this study can serve as semantic models when exchanging the evidence for student's higher and secondary education qualifications, which is needed to be provided to the academic institution during the process of applying for studies and study grants. Through the pilots set up with three countries, the definitions of the concepts in the data models, their meaning and viability are tested. These final data models (canonical evidences), hence, can be used by any public institution when they implement procedure portals for exchanging electronic data cross-border, allowing students from other countries to apply remotely. Such a provision enables universities to open up their education efficiently and effectively outside the borders of their country. Such an approach will also help minimize the fraud and possibility to present wrong information, since the evidence are being received not from a citizen but from an accredited trusted public agency. This will also allow autonomy of the process since the whole process is electronic and in real time.

This study achieved the goal of creating harmonized data models (canonical evidences) that are technically, legally and semantically verified together with the respective competent authorities in public (education) service. However, the study is limited to developing only the canonical evidence (the information needed for cross-border services enhancing student mobility). The metadata and process models for information exchange, which is the other absolute necessity, do not fall under the scope of this work, but would be the essential next step towards achieving a complete cross-border information exchange.

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References

Berberidis, Christos, H. Shah Syed Iftikhar, Eleni Konstantinidis, Thashmee Karunaratne, and Ana Rosa Guzman. 2020. 'D3.3 Semantic Framework – Initial Version'. 2020. https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5d5479650&appId=PPGMS.

'Bologna Process - University of Bologna'. n.d. Accessed 6 June 2022. https://www.unibo.it/en/international/agreements-and-networks/bologna-process/bologna-process.

Borghetti, Claudia, and Ana Beaven. 2017. 'Lingua francas and learning mobility: reflections on students' attitudes and beliefs towards language learning and use'. *International Journal of Applied Linguistics* 27 (1): 221–41. https://doi.org/10.1111/ijal.12123.

Choudaha, Rahul, and Li Chang. 2012. 'Trends in International Student Mobility'. SSRN Scholarly Paper 2184988. Rochester, NY: Social Science Research Network. https://papers.ssrn.com/abstract=2184988.

'Data Protection Impact Assessment (DPIA)'. 2018. GDPR.Eu. 9 August 2018. https://gdpr.eu/data-protection-impact-assessment-template/.

DE4A. 2020. 'European Digital Public Services | London UK | Digital Europe For All'. DE4A. 2020. https://www.de4a.eu.

DE4A Consortium. 2020a. 'D4.1 Studying Abroad - Use Case Definition & Requirements', 138.

———. 2020b. 'D7.2 Initial Report on Legal and Ethical Recommendations and Best Practices', 58.

———. 2022. 'D3.2 Final Requirements for Semantic Assets'. https://www.de4a.eu/project-deliverables.

EC. n.d. 'Single Digital Gateway'. The Single Digital Gateway and Your Europe. Accessed 14 May 2022. https://ec.europa.eu/growth/single-market/single-digital-gateway_sv.

EU publication office. n.d. 'Country Codes XML Schema'. Accessed 8 June 2022a. http://publications.europa.eu/resource/authority/country.

———. n.d. 'ISCED Code List XML Schema'. Accessed 8 June 2022b. https://publications.europa.eu/resource/authority/snb/isced-f/25831c2.

———. n.d. 'Mode of Study Code List - XML Schema'. Accessed 8 June 2022c. https://publications.europa.eu/resource/authority/snb/learning-schedule/25831c2.

EUR-Lex. 2014. *Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on Electronic Identification and Trust Services for Electronic Transactions in the Internal Market and Repealing Directive 1999/93/EC*. *OJ L*. Vol. 257. http://data.europa.eu/eli/reg/2014/910/oj/eng.

Europass. n.d. 'About Europass Learning Model | Joinup'. Accessed 7 June 2022. https://joinup.ec.europa.eu/collection/semantic-interoperability-community-semic/solution/europass-learning-model/about.

Hefler, Günter, and Eva Steinheimer. 2020. *Measuring Learning Mobility in Vocational Education and Training: A Review of Data Sources and Approaches to Measurement across European Union Member States*. *European Commission*. European Commission. https://doi.org/10.2767/693519.

'Higher Education | European Education Area'. n.d. Accessed 6 June 2022. https://education.ec.europa.eu/node/1750.

'Home | Erasmus+'. n.d. Accessed 6 June 2022. https://erasmus-plus.ec.europa.eu/.

'Homepage | ISA^2'. n.d. Accessed 15 May 2022. https://web.archive.org/web/20220305115218/https://ec.europa.eu/isa2/home_en.

Joint Research Centre (European Commission), Patrícia Dinis da Costa, Sara Flisi, and Elena Soto-Calvo. 2015. *Learning Mobility*. LU: Publications Office of the European Union. https://data.europa.eu/doi/10.2760/590538.

Peffers, Ken, Tuure Tuunanen, Marcus A. Rothenberger, and Samir Chatterjee. 2007. 'A Design Science Research Methodology for Information Systems Research'. *Journal of Management Information Systems* 24 (3): 45–77. https://doi.org/10.2753/MIS0742-1222240302.

Piswanger, C.-M., P. Helger, and K. John. 2019. 'A Shortcut on «The Once Only Principle Project» (TOOP)'. *Jusletter IT*. https://ezp.sub.su.se/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=edselc&AN=edselc.2-52.0-85073078419&site=eds-live&scope=site.

Rivza, Baiba, and Ulrich Teichler. 2007. 'The Changing Role of Student Mobility'. *Higher Education Policy* 20 (4): 457–75. https://doi.org/10.1057/palgrave.hep.8300163.

TAYLOR, Lydia. 2018. 'Common Architecture for the Single Digital Gateway'. Text. ISA^2 - European Commission. 19 March 2018. https://ec.europa.eu/isa2/actions/common-architecture-single-digital-gateway_en.

UBL. 2019. 'Universal Business Language (UBL) 2.0 Naming and Design Rules'. 2019. http://docs.oasis-open.org/ubl/cs01-UBL-2.0-NDR/cs01-UBL-2.0-NDR.html.

W3C. n.d. 'Standards - W3C'. Accessed 7 June 2022. https://www.w3.org/standards/.

Universal Design and Language Teaching: Disrupting the Pedagogies of Realistic Mixed-Ability Teaching

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Abstract: Although computer-assisted language learning and computer-assisted learning can be seen to be the precursors of if not simply the very backbone of E-learning, it is still rare to connect E-learning with special education needs (SEN) pedagogy. The full potential of cross-breeding computer-assisted language learning and Universal Design for Learning has been experimentally investigated by this author, but apparently not by others. Findings in the above-mentioned studies point to augmented learning opportunities for the whole classroom by aiming to offer comprehensive scaffolds design reaching out to SEN learners. The comprehensive SEN-compatible design, though, can be used, as the author has documented (Kasch 2019, 2020) by non-struggling average and above-average learners as well so as to virtually disrupt the classical language pedagogical ideas of having to face the limits of "realistic mixed-ability teaching". Rather, as a few studies also point to - e.g. , E-Learning pedagogy can be enlightened by Universal Design for Learning (UDL) and thus offer learners what they need, being offered scaffolds and support they did not think belonged in language learning materials. This presentation will look at struggling and non-struggling learners' experiences of using assistive universally designed E-learning materials in interview responses (n = 32) in English language learning and come up with a proposal for how UDL can inspire language learning in E-learning designs and pedagogy in general so as to disrupt pedagogical thinking underlying contemporary E-learning designs in language teaching.

Keywords: universal design for learning, computer-assisted language learning (CALL), special education needs (SEN), computer-assisted learning (CAL), innovation

1. Background

Computer-assisted language learning and computer-assisted learning can be considered precursors of – if not very backbone of E-learning. In both paradigms and in E-learning as well, it is still rare to connect E-learning with special needs education (SEN) pedagogy. In this paper, the author will present a case for disrupting "realistic mixed ability teaching" (Harmer, 2007, p. 131), which is an inscribed idea in foreign language and other non-SEN pedagogies – that there are indeed limits to differentiated teaching in the classroom and certain levels of proficiency gaps that the pedagogies cannot accommodate. A wholly other train of thought is presented in Universal Design and Universal Design for Learning (Story et al., 1998; Rose & Strangman, 2007). In both Universal Design (in architecture and product design) as well Universal Design for Learning, the pivotal ideas is that diversity and variability in users and learners are always the point of departure. According to this train of thought, therefore, teaching and learning designs should strive to accommodate cognitive and social diversity and variability at the outset, rather than come up with a retro-fit solution. This idea of embracing diversity and variability also appears to be reflected in the foundational ideas of open education in E-learning, namely with the 4 A's ("availability", "accessibility", "acceptability" and "adaptability") - cf. e.g. Benlamri et al. (2016, p. 3). On this note, the paper will closely examine whether the widely held belief of "realistic mixed-ability teaching" in foreign language pedagogy is justifiable vis-à-vis empirical research in E-learning and the underlying beliefs in foreign language pedagogies used in English Language Teaching.

2. Contents and method

In the case study, the author will first examine state-of-the art of SEN-pedagogy including Universal Design (for Learning) in E-learning research in a literature review and then confront the findings of this state-of-the-art of research with the current pedagogies in language teaching. Then two cases will be presented. In the first case, the findings of literature studies will be used to confront the current SEN-pedagogical practice of co-teaching and how co-teaching could work out in a classroom aiming to disrupt the pedagogical idea of "realistic mixed ability teaching". Here, data from the author's empirical studies will be presented for further illustration and inspection. Then, a rival case of "co-teaching", which has of late enjoyed a renaissance in Nordic countries, is analyzed and discussed. Eventually, a conclusion is presented summing up the main findings and road-mapping for future research.

3. Literature review and state of the art

SEN pedagogy in E-learning is apparently understudied, as is indeed suggested if one searches the ProQuest database using the truncated search string in ProQuest, ab(E-learning) AND ab("special needs education"). The author conducted this search which returned only 3 non-duplicate hits, of which 2 were especially relevant. One study was the study by (Fukushima and Masataka, 2010) providing a discussion of existing research and pointing to potentials of integrating SEN in E-Learning. In an empirical study, Levinsen (2008), showed how remedial general-purpose compensatory/assistive literacy aids can be used by dyslectic and non-dyslectic students in the classroom alike to teach to boost writing proficiency. Eventually, Benlamri et al. 's (2016) editorial from a journal issue on E-learning and Management Information does define open access as having to do with the 4 A's (Benlamri et al., 2016, p. 3) of being "available" to all users, of being "accessible" to and "acceptable" to all users as well as "adaptable" to unique needs of and cultures of constituents including inter alia minorities, indigenous people and people with disabilities.

Broadening the literature search, the author conducted an additional literature search looking into Universal Design and E-learning using the truncated search string, ab("Universal Design") AND ab("E-learning"), was used, which returned 4 genuine hits. Of these, an article by De Angelis (2020) argues that a deeper understanding of the inclusive potentials is needed with a view furthering accessibility, usability and sustainability for Italian higher-education sectors to be up to international standards of inclusive practice in E-learning. In a study Universal Design and E-learning designs and analytics, Buenaño-Fernández & Luján-Mora (2019) proposed that educational tools for data-mining and process mining be used to identify the dangerous points of learning routes for visually impaired learners in MOOCs. A further conceptual study of Universal Design for Learning in Italian Schools and E-learning is provided in (Aiell*o et a*l., 2018) of how the nuances of planning teaching can be enlightened using UDL. Eventually, Al-Azawei et al. (2017) using a mixed method of survey and action in a study of E-learning acceptance found that educational technologies can be used to tackle curricula limitations guided by UDL principles and act as a bridge to enhance E-learning acceptance.

As can be seen from the sources of the above literature review, a rich potential in having E-learning reach out to learners outside the perimeters of more or less idealized average learners and users is hinted at in E-learning literature. However, deeming from the above searches appears, Universal Design and SEN-pedagogy appears to be largely understudied. Further, although the literature seems to be keenly aware that there are potentials of E-learning and Universal Design and adaptable accessibility, very few empirical studies appear to address Universal Design in E-learning (Kasch, 2019, 2020). In computer-assisted language learning, studies by Kasch (2021; 2018, 2019) are thus found which test the viability of Universal Design and computer-assisted language learning. When searching ProQuest using the search string, "ab("Universal Design for Learning") AND ab("Computer-assisted Language Learning") AND ab("empiric*"). Similar searches in Scopus yield the same result. Kasch (2021; 2018, 2019) appears to have conducted the only studies of the viability of special education needs oriented E-learning in foreign language classrooms. A near-exception, though, is an empirical study of Universal Design being used in literacy and second-language teaching in a US classroom featuring English-as-a-second-language (ESL) learners and struggling readers (Proctor, Dalton and Grisham, 2007). All studies (Proctor, Dalton and Grisham, 2007; Kasch, 2019; H. Kasch, 2021) though point to the pedagogical viability of integrating Universal Design for Learning into language classrooms.

4. The case for a disruption of "realistic mixed-ability teaching" in the light of empirical research and e-learning research literature

In classical or standard textbooks on (the practice of) English language teaching like (Harmer, 2007, p. 131) it is customary to speak of "realistic mixed-ability teaching" and not to see language teaching from a Universal Design or SEN-pedagogical perspective. Likewise, standard textbooks on "how languages are learned" i.e. on foreign language acquisition theory and research (Lightbown and Spada, 2013) and pedagogy/teaching practice do not address special education needs. Neither when explaining language learning do Lightbown & Spada (2013, pp. 103–120) address SEN or UDL issues; nor do they do so when presenting pedagogical approaches to language teaching (Lightbown and Spada, 2013, pp. 153–198). Further examples of textbook classics failing to address SEN pedagogy or UDL are the classic by Hedge (2001) on teaching and learning in the language classroom failing to incorporate UDL or SEN pedagogy. Yet another classic that does not provide any illustration of SEN learners and SEN-oriented pedagogies is the otherwise very scaffolding-aware textbook on language teaching by Gibbons (2015).

Apparently, the pedagogical philosophy inscribed in language learning and pedagogy is that certain learners are not relevant regarding / worthy of having their language learning studied and that language teaching is most appropriately studied as an abstract or general (non-SEN) phenomenon. The apparent upshot of this is that whatever SEN-oriented differentiation measure the teacher might want to apply in their teaching will be pedagogically extraneous both in terms of SEN and of foreign language pedagogy applied. In other words, SEN measures will be extraneous add-ons to the general pedagogies and theories used to inform and provide the reasoning and arguments behind their (language) teaching (proper), that is the planning, implementation, assessment and development of teaching. In a nutshell, whatever SEN-pedagogical measures that teacher integrates in their teaching, they will be informed by SEN pedagogy only and in not aligned with the theories otherwise informing language teaching (Quuvan*g et a*l., 2016).

Ron Mace, the founding father of Universal Design in architecture and design, found that for people with reduced mobility like himself, cityscapes and rural landscapes alike were hostile or at least not very accommodating to him. Today, in a very similar way, SEN-learners still find themselves in language classrooms, whose pedagogical reasoning and theory do not accommodate them or consider them worthy of study. Conversely, SEN-pedagogical practice is, on the other hand, typically uninterested in embracing the pedagogies of individual disciplines, such as e.g. foreign language pedagogy – see e.g. (Quuvan*g et a*l., 2016). This pedagogical illogical and hardly very practical dichotomy is even found at teacher education departments. As a result, foreign language educators and researchers specialize in their subjects and pedagogies and SEN educators and researchers specialize in SEN. In a similar fashion, SEN pedagogy or UDL only exceptionally makes it into computer-assisted language learning cf. above or into (post-secondary) STEM teaching (Schreffler, Vasquez III, Chini and James, 2019).

At the teacher education department, then, the SEN educator may appear in one corner and enlighten the preservice teacher on the merits and necessity of SEN pedagogy. However, they will do so out of alignment with the language teaching educator in much the same way that Computer-assisted Language Learning and Universal Design (for Learning) had not been crosspollinated prior to Kasch (2021; 2018, 2019). However, as pointed out in Kasch (2018) a universal design can be used to expand teacherly contingencies and also call for a complete disruption of instructional materials design. Kasch (2021; 2018, 2019) tried out Ebook prototypes in serial experimental studies with subsequent semi-structured interviews (n = 32) in Danish year-seven English as a Foreign-Language classrooms. In these studies, SEN-pedagogical E-learning components were studied. The Ebook prototypes thus comprised assistive learning-design components, amongst them:

1. 1. A comprehensive non-lemmatical (glosses given in the form in which they appeared in the text and not in their base form as is customary) contiguous (glosses glossed together in context) multimodal (text, sound and image) and bilingual (English and Danish) glossing functionality
2. 2. A bilingual (Danish and English) retelling functionalit re-telling the contents of every paragraph or page in the Ebook prototype
3. 3. A text-to-speech (TTS) functionality with synchronous highlighting.

These components with a clear SEN-pedagogical and UDL leaning were found not only to enhance access to participation and meaning comprehension for the strugglers in the classroom, but also stimulate engagement and learning in the whole classroom (Kasch, 2021; 2018, 2019). As for 1, glossing formats were found to reach out to and be used by all struggling learners and found to scaffold lexical comprehension as well as scaffold self-regulated learning by the multimodal and SEN-oriented glossing format, but also average and above-average learners found the glossing formats a way to increase engagement in terms of eased access to glossing, giving them a way apparently of understanding the text for the first time and have a meaningful learning process. As for 2, the bilingual retelling functionality offered an opportunity often together with the TTS functionality to find a way into the meaning content of the text for the very strugglers, whereas other non-struggling learners used it for testing a hypothesis of the meaning content of the text and still others would use for sheer enjoyment listening to natural English rather than the mechanic-sound TTS. As for 3, the TTS functionality, struggling learners would use it for practicing reading e.g. together with the Retelling functionality in English and in Danish, whereas others would use it for listening to the pronunciation of a given phrase or even for practicing the pronunciation of a given phrase. Many more uses were found, though, by Kasch (2019, 2021), and the reader is referred to Kasch (2019, 2021) for further details. Suffice it here to say that both self-regulated learning and increased learning engagement arose from the affordances as expounded by the informants in their interviews. Overall, interview responses suggested that moving barriers

to learning and embracing variability in the classroom led to improved inclusive practice in the language classrooms.

Findings in Kasch (2021; 2018, 2019) and (Levinsen, 2008) thus all support the idea that SEN-pedagogical assistive technology can increase participation and engagement in the whole classroom. This presents us with a two-fold argument for Universal Design in the classroom and for allowing all learners access to all (even remedial) resources. Not only does it make sense to integrate language pedagogy and SEN-pedagogy to include struggling learners in the language classroom and make them have access to learning and engagement, as suggested by (Kasch, 2021), non-struggling learners are also afforded new accesses to learning and engagement. In other words, time may seems to be ripe for a disruption of instructional materials, naturally integrating SEN-pedagogies and foreign language pedagogies, doing away with the axiomacy of "realistic mixed ability teaching". Likewise, post-secondary STEM teaching corroborate the viability of UDL at higher levels of education (Schreffler, Vasquez III, Chini and Westley, 2019).

More succinctly perhaps, from Universal Design point of view, it is hard to defend foreign language pedagogies if their learning designs are only for the able or non-SEN students. With non-SEN pedagogies insisting that SEN pedagogy is not part of language or general pedagogy proper (whatever that would be), we are left the with the dilemma of trusting a non-SEN-pedagogical understanding of scaffolding, resources and barriers to learning. As a consequence, then the very understanding of "realistic" or "realism" is ungrounded in SEN research which, contrary to non-SEN pedagogies, specializes in finding learner resources and barriers to learning (Norwich & Lewis, 2007; Quvang et al., 2016; Rose & Strangman, 2007). However, of late, an approach has been launched to alleviate SEN-pedagogical exigencies in normal mixed-ability classrooms, the idea being a pooling of SEN expertise and teacher expertise so that the classroom can be offered resources from both SEN and non-SEN pedagogies and teaching, namely co-teaching. In many ways, the method seems to live up to the 4 A's and also principles of universal design in trying to embrace learner diversity and variability. The author therefore now turns to a discussion of this rival case, which is now enjoying a heyday in Denmark and other Nordic countries as SEN-pedagogy-compatible approach to cater to mixed-ability classrooms (see e.g. *Co-Teaching | Emu Danmarks Læringsport*al).

5. The rival case of co-teaching in mixed-ability classrooms: Is disruption really needed?

Perhaps disruption is not needed, as the current trend of co-teaching could perhaps supply the resources needed in the mixed-ability classroom. Co-teaching (Cook and Friend, 1995) can be understood as and is also offered as a solution to inclusive practice, embracing SEN pedagogy with the co-teacher as an additional resource with a meaningful pedagogical role to play in classrooms with a number of SEN learners. As Cook & Friend (1995) suggest, co-teaching is especially efficient when there are no or few problems of collaboration between teacher and co-teacher and if the task of the co-teacher has no or little bearing on the pedagogy offered by the teacher. Even so, on the face of it, co-teaching appears to function like a retro-fit solution to a dysfunctional pedagogical design, just the way, adding a ramp to a school building may help students with reduced mobility to enter the classroom. This notwithstanding, SEN-pedagogical co-teaching still aspires to embrace variability and diversity in the mixed-ability classroom. The problem, though, is that it does not consider and embrace diversity at the outset of the overall teaching design or follow from an overall pedagogically integrated methodology or plan (see e.g. Story et al., 1998). Co-teaching rather leaves it to the SEN specialist tackle SEN problems in their stride or according to a planned division of labour in the classroom such that the teacher does and assumes responsibility for the (non-SEN) teaching proper (Dedering and Lindacher, 2018).

Therefore, albeit that it may always be nice to have more resources in the classroom, co-teaching is still subject to an understanding of pedagogy such that SEN pedagogy and teaching (pedagogy) are segregated with the teacher teaching and the (SEN specialist/teacher) assistant assisting - cf. e.g. (Cook & Friend, 1995; Dedering & Lindacher, 2018). In this way, co-teaching is considered not just something that should be dealt with in segregation but also as SEN pedagogy being subservient to teaching. In contrast, a Universal Design perspective presents a proposal to sublate this dichotomy of pedagogies by combining them to construct new meaningful pedagogies by integrating UDL principles into the pedagogy in general and the pedagogies of individual disciplines (Gordon, Meyer and Rose, 2010). Such integrated pedagogies, which are however yet to be constructed, are not bounded by imagined perimeters of "realistic mixed-ability teaching" or the prevalent pedagogy in language teaching and acquisition research that does not address or embrace SEN pedagogy.

As pointed out in meta-studies on co-teaching, substantial learning effects are yet to be documented (Murawski and Swanson, 2001; Dedering and Lindacher, 2018). However, many studies in co-teaching do report successful and meaningful cooperation - see e.g. Murawski & Swanson (2001). Rather than throwing the baby out with bathwater, a Universal Design-inspired approach could be proposed for and used in co-teaching disrupt or inform existing co-teaching ideas. This would call for a pooling of resources to have SEN pedagogy inform the pedagogy of disciplines and vice versa on all levels from research to teacher education to practioner, i.e. SEN and non-SEN teacher level, and be embodied by instructional materials and pedagogies. On the basis of such a disruption, the illogical dichotomy of SEN pedagogy and other pedagogies could be resolved or even synthesized/sublated into a meaningful and inclusive understanding of pedagogy. In this understanding, teaching and education are indeed for the whole classroom and for all. Teaching and education could then be genuinely inclusive rather than just for the able non-SEN learners inside the perimeters of "realistic mixed ability teaching". In other words, the pedagogies of teaching "proper" could really become pedagogical rather than leave learners off by the wayside. A caveat is in order here, though, namely that the integration suggested is by no means proffered as a vehicle to lower costs; nor does it proffer to abandon the pools of knowledge gleaned by SEN and non-SEN pedagogies – rather, it wants to bolster all pedagogies by having them enter into a meaningful dialogue and exchange of knowledge to tackle the admittedly wicked problem of inclusion.

6. In conclusion

In this case study, I have used a literature review and my own research on E-learning and Universal Design for Learning and SEN-pedagogy to tell a story of the strange - and to me – illogical dichotomy of SEN pedagogy and other pedagogies – be they general or be they the pedagogy of specific disciplines. In E-learning research, though, the tenets of a disrupting pedagogy doing away with or challenging this dichotomy can already be seen to emerge. A case in point are the "4 A's" used to guide open education E-learning designs (Benlamri, Klett and Wang, 2016), but also by findings in UDL and SEN studies in E-learning point to solutions integrating SEN-pedagogy with pedagogies from individual subjects. Thus, the literature review of the case study as well as the author's own empirical research pointed to theoretical as well as practical viability of integrating UDL and SEN-pedagogy in language learning and other area such as literacy teaching. This research appeared to be in marked contrast to classical foreign language pedagogies, in which inclusive UDL-inspired pedagogies were seen not to be given lip service, nor were SEN learners and SEN pedagogy. Conversely, as suggested by the rival case study presented, current SEN-pedagogical solutions like co-teaching also segregate SEN pedagogy from teaching, with the teacher teaching and the SEN co-teacher co-teaching . In order to solve the apparent wicked problem of inclusion, a sustainable solution, it would stand to reason, is in need of a bird's eye view of the multi-facetted pedagogical landscape. This could be constructed by disrupting "realistic mixed-ability teaching" and substitute it for collaboration and integration of SEN and Non-SEN pedagogies of the individual disciplines.

Such a solution could be imagined to embrace the three blocks of UDL of learner diversity and variability in ("affective", "cognitive" and "strategic" networks) and take the 4 "A's" of open education, namely "Availability", "Acceptability", "Accessibility" and "Adaptability", very seriously (Benlamri, Klett and Wang, 2016, p. 3). In doing so, educational, psychological and pedagogical sciences and areas of expertise could team to up and strive to provide solutions with a sustainable universal design rather than the retrofit and segregated ones researchers and educators as well as teachers may be only too familiar with. On this note, future research into Universal Design-inspired disruptive pedagogies could be envisaged for many levels - all the way from huge research programmes to practioner collaboration research and so that SEN-pedagogy would become part of all pedagogies, and co-teaching and teaching could be synthesized into meaningful and inclusive teaching.

References

Aiello, P. et al. (2018) 'Inclusion and Universal Design for Learning in Italian Schools', in Online Course Management: Concepts, Methodologies, Tools, and Applications, pp. 559–566. doi: 10.4018/978-1-5225-5472-1.ch030.

Al-Azawei, A., Parslow, P. and Lundqvist, K. (2017) 'The Effect of Universal Design for Learning (UDL) Application on E-learning Acceptance: A Structural Equation Model', International Review of Research in Open and Distance Learning, 18(6).

De Angelis, B. (2020) 'E-learning e strategie inclusive: uno studio per rilevare le opinioni dei docenti dell'Università Roma Tre TT - E-learning and inclusive strategies: A study designed to detect teachers' opinions of the Roma Tre University', Journal of Educational, Cultural and Psychological Studies, 21, pp. 357–366.

Benlamri, R., Klett, F. and Wang, M. (2016) 'Editorial: Models, technologies and approaches toward widening the open access to learning and education', Knowledge Management & E-Learning, 8(1), p. 1.

Buenaño-Fernández, D. and Luján-Mora, S. (2019) 'Propuesta de aplicación de minería de procesos para evaluar las rutas de aprendizaje de estudiantes con discapacidad visual en cursos en línea TT - Proposal of application of process mining to evaluate the learning routes of students with visual disabili', Revista Ibérica de Sistemas e Tecnologias de Informação, (E17), pp. 1035–1047.

Co-teaching | emu danmarks læringsportal (no date). Available at: https://emu.dk/grundskole/corona-gode-raad-til-undervisning/co-teaching (Accessed: 15 August 2022).

Cook, L. and Friend, M. (1995) 'Co-teaching: Guidelines for creating', Focus on Exceptional Children, 28(3), pp. 1–16.

Dedering, K. and Lindacher, T. (2018) 'Unterrichtliche Kooperation zwischen Professionellen an inklusiven Schulen. Überblick zum Forschungsstand', DDS – Die Deutsche Schule, 110(3), pp. 263–274. doi: 10.31244/dds.2018.03.07.

Fukushima, M. and Masataka, N. (2010) 'Application of cognitive science in special needs education', Cognitive Studies: Bulletin of the Japanese Cognitive Science Society, 17(2), pp. 356–362.

Gibbons, P. (2015) Scaffolding Language, Scaffolding Learning: Teaching English Language Learners in the Mainstream Classroom. 2nd edn. Portsmouth, NH: Heinemann.

Gordon, D., Meyer, A. and Rose, D. (2010) 'Re-Envisioning Education through UDL', Universal Design for Learning: Theory and Practice, pp. 1–20. doi: 10.1111/1744-7917.12072.

Harmer, J. (2007) The Practice of English Language Teaching. Harlow, London: Pearsson.

Hedge, T. (2001) Teaching and Learning in the Language Classroom | Professional Development | Oxford University Press. Oxford: Oxford University Press.

Kasch, H. (2018) 'New Multimodal Designs for Foreign Language Learning', Learning Tech -Tidsskrift for læremidler, didaktik og teknologi, 5, pp. 28–59. doi: 0.7146/lt.v4i5.111561.

Kasch, H. (2019) 'Experimental Studies of the Affordances of Assistive Multimodal Learning Designs: Universal Design for Learning in Modern Language Classrooms', JISTE, 23(2), pp. 93–107.

Kasch, H. (2020) 'Innovative Inclusive Educational Technology in Language Classrooms and Learner Perspectives: A Study of Nine Learner Narratives', in Brooks, A. and Brooks, E. I. (eds) Interactivity, Game Creation, Design, Learning, and Innovation 8th EAI International Conference, ArtsIT 2019, and 4th EAI International Conference, DLI 2019, Aalborg, Denmark, November 6–8, 2019, Proceedings. Berlin, Heidelberg: Springer, pp. 660–670. doi: 10.1007/978-3-030-53294-9_50.

Kasch, H. (2021) 'Inclusive multimodal designs in language classroom: Three empirical studies', in Proceedings of the European Conference on e-Learning, ECEL, pp. 240–247. doi: 10.34190/EEL.21.023.

Kasch, Henrik (2021) 'Inclusive Multimodal Designs in Language Classroom: Three Empirical Studies', in Busch, C., Friess, R., and Wendler, T. (eds) Proceedings of the 20 th European Conference on e - Learning ECEL 2021. Reading, UK: ACI, pp. 240–247. doi: DOI: 10.34190/EEL.21.023.

Levinsen, K. T. (2008) 'Reinventing Papert's Constructionism--Boosting Young Children's Writing Skills with e-Learning Designed for Dyslexics', Electronic Journal of e-Learning, 6(3), pp. 227–234.

Lightbown, P. M. and Spada, N. (2013) How languages are learned. 4th edn. Oxford: Oxford University Press.

Murawski, W. W. and Swanson, H. L. (2001) 'A meta-analysis of co-teaching research: What are the Data?', Remedial and Special Education, 22(5), pp. 258–267. doi: 10.1177/074193250102200501.

Norwich, B. and Lewis, A. (2007) 'How specialized is teaching children with disabilities and difficulties?', Journal of Curriculum Studies, 39(2), pp. 127–150. doi: 10.1080/00220270601161667.

Proctor, C. P., Dalton, B. and Grisham, D. L. (2007) 'Scaffolding English language learners and struggling readers in a universal literacy environment with embedded strategy instruction and vocabulary support', Journal of Literacy Research, 39(1), pp. 71–93. doi: 10.1080/10862960709336758.

Quuvang, C. et al. (2016) Specialpædagogik - en introduktion . Copenhagen: Hans Reitzel. Available at: https://hansreitzel.dk/products/specialpadagogik-en-introduktion-bog-39977-9788741263298 (Accessed: 17 August 2022).

Rose, D. H. and Strangman, N. (2007) 'Universal Design for Learning: Meeting the challenge of individual learning differences through a neurocognitive perspective', in Universal Access in the Information Society, pp. 381–391. doi: 10.1007/s10209-006-0062-8.

Schreffler, J., Vasquez III, E., Chini, J. and Westley, J. (2019) 'Universal Design for Learning in postsecondary STEM education for students with disabilities: a systematic literature review', International Journal of STEM Education, 6(1), pp. 1–10. doi: http://dx.doi.org/10.1186/s40594-019-0161-8.

Schreffler, J., Vasquez III, E., Chini, J. and James, W. (2019) 'Universal Design for Learning in Postsecondary STEM Education for Students with Disabilities: A Systematic Literature Review', International Journal of STEM Education, 6, pp. 1–10. doi: http://dx.doi.org/10.1186/s40594-019-0161-8.

Story, M. F., Mueller, J. L. and Mace, R. L. (1998) The Universal Design File: Designing for People of All Ages and Abilities. North Carolina University, Center for Universal Design.

An Educational Cultural Game for an Industrial Urban Landscape

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Abstract: This paper presents an educational game that aims to enhance students' logical, mathematical, linguistic, and other skills by introducing them to the landscape of Drapetsona, an area in the southern part of Piraeus, Greece, with rich labor history and many industrial monuments, highlighting its industrial heritage and its remains. This educational game is a point-and-click puzzle game with multiple character control. It is aimed at students between the ages of 8-18 years, with graded difficulty depending on the player's age, making it interesting and attractive for any child with moderate access to technology. Our educational structure incorporates inventory, map, and game. A modern platform has been selected for its development that does not require programming and can be easily used by anyone who wants to improve the design of the game. With those digital tools, designing the game is a creative, enabling experience that is accessible to all. The game is currently under construction and a way of evaluating it is proposed.

Keywords: educational games, culture, education, industrial heritage, local history

1. Introduction

Considering the need for a change in educational policy, and therefore in teaching methods, it is necessary to enforce them with the utilization of digital media, as we live in the era of transition to digitality, in which the structure of the world and society will necessarily adapt to the new circumstances (Ghavifekr & Rosdy, 2015). This transformation toward digitality leads to the debate on Digital Culture and its interpretation. According to Jean-Sébastien Guy (Guy, 2019), the digital transformation of society sets digital technology as a necessary, albeit insufficient, condition. A necessary condition is for digital technologies to acquire social meaning. Today's digital civilization has emerged, not as an extension of the possibilities offered by digital technology, but as a social choice with consequences for digital technology itself, as well. Digital culture does not reflect reality, that exists before or outside it, but it creates its own. Jean-Sébastien Guy uses the extremely apt example of the car to explain the distinction between technology and car culture.

Since digital technologies are beginning to define people's lives, from their work to the simplest activities of daily life, they cannot be absent from education, where they are both useful tools for learning and for instructing students on how to use them, since they will gradually become necessary for every field. While supported and implemented by most educators, traditional teaching methods have failings and shortcomings, especially in our rapidly evolving society, due to new technologies. Those can be summarized in four points:

- They do not succeed in piquing the learners' interest and the learning objects are often perceived as chores. For this very reason, they are treated by students superficially to satisfy their teachers or to just get a grade on each subject without any intention of further deepening.
- They struggle to provide meaningful knowledge, since they promote sterile memorization of the learning material provided by the teacher, without the intention of enabling the students to actively participate and prompting them to discover on their own or even question the accepted knowledge.
- Students have difficulty combining the knowledge provided at school with contemporary reality and everyday life and thinking.
- Traditional teaching methods also seem to mainly aim at providing ready-made knowledge rather than cultivating critical thinking and filters for processing data and allowing students to reach their conclusions. In other words, the emphasis is on information ('what') rather than on the way of thinking and concluding ('how') (Husbands, Kitson & Pendry, 2003).

The purpose of this research is the design an educational game that will be used as a means of teaching the local history of Drapetsona and its industrial inheritance. This publication will attempt to implement the promotion of cultural elements through digital media to create an innovative educational approach, by digitizing material concerning the industrial heritage of Drapetsona, both tangible and intangible, and incorporating them in a

digital game that will attempt to interact with the players thus creating a dynamic learning experience. The present paper attempts to highlight the importance of local history in general and industrial heritage in particular and the necessity of its introduction in the educational process (Fig. 1).

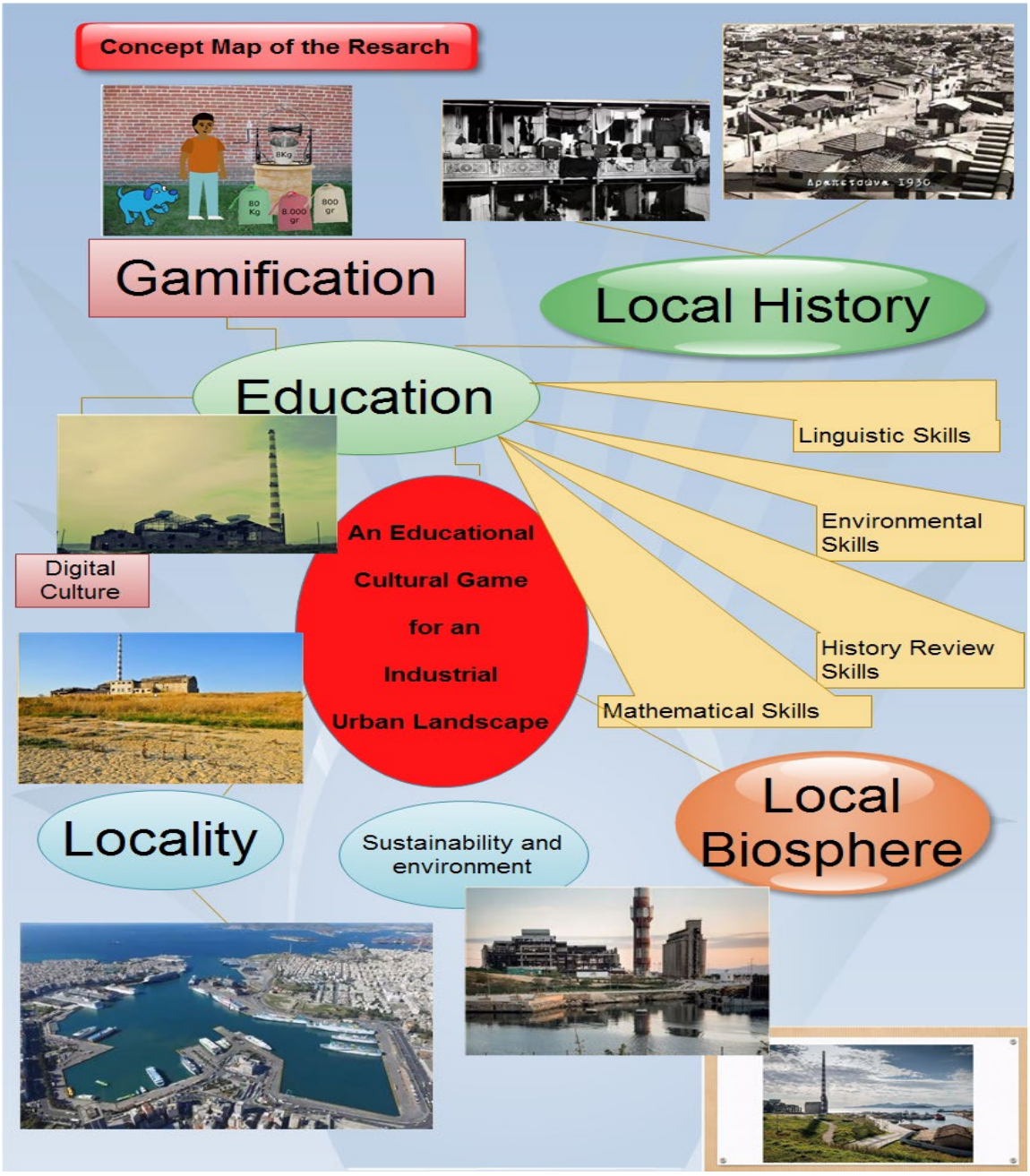

Figure 1: The conceptual map of the educational cultural game development

Our first attempts derive from the importance of preserving collective memory and the way a place's past has the power to define its character and its citizens, so it seems crucial to inform young people and provide them with knowledge about the cultural heritage of their place or even other places. The fact that this is attempted through a digital game is because another objective is to stimulate the interest of children, adolescents, and young people generally, by introducing them to a more entertaining way of learning, and also to raise their awareness of their place and cultural issues in general. Apart from enriching the cultural aspect, we strive to improve the skills students develop through the educational process within the school environment, such as those relating to mathematics, language, history, etc. This aims at upgrading and modernizing the educational process to meet the needs and habits of young people, which are largely influenced by technological progress, thus requiring the use of advanced digital technologies. This article, in addition to the introductory part, contains a second chapter dedicated to learning about Local history and industrial heritage in education through digital

games, a third chapter on the Cultural Educational Game for the Industrial Heritage of Drapetsona, and a fourth part analyzing Game Semantics. Finally, it concludes by presenting the Results - Conclusions and listing the Bibliography.

2. Local history and industrial heritage in education through digital game

Each country's industrial history is important because the preservation of collective memory helps us understand the relations of production and how these relations were formed. After all, Art isn't solely focused on aesthetics but it also aims at showcasing the evidence of the real, hard everyday life of the poor strata, i.e., the great majority of the Greek population, and that is of equal - if not greater - importance and significance for our history and culture as any archaeological find. The images of refugee camps, factories, strikes, strike mobilizations, and traditional popular music ("etiquettes and rebetiko" bands), may seem distant, but if someone visits Drapetsona, they will realize that the area has been shaped and has formed its characteristics and physiognomy precisely by these elements, that now constitute history. Therefore, since history, as always, leaves behind its indelible traces, even in forms that are not always visible to the naked eye, it is of primary importance that it is studied and highlighted and, above all, protected from fading into oblivion. The remaining industrial monuments of Drapetsona constitute the "Parthenon" of the Greek industrial heritage from a historical, social, architectural, and anthropological point of view and it is a necessity to introduce industrial heritage in education in combination with the importance of local history.

This research focuses on solving a problem with dual restrictions. The first one is the inability of traditional educational processes to stimulate the student's interest and motivate them towards better performances. The second one is the alienation of young people from cultural heritage and specifically the cultural heritage of their place. The introduction of local history in general and industrial heritage in particular into education is vital for the students' cultural cultivation and the protection and preservation of collective memory. ICTs can contribute to the integration of local history in education in interactive and experiential ways, alongside the traditional method of linear narrative, which seems poor and sterile in comparison, as it does not foster critical faculties and mainly aims at rote learning. The digital game, specifically, with vehicles for visualization, challenge, problem-solving, and discovery makes learning more active and efficient.

2.1 Local history and industrial heritage in education

The educational process, apart from creating a common ground aiming at offering students a standard level of education characterized by homogeneity, can also take on more individualized characteristics, in the same way, that after the completion of compulsory education, there are both common general education and directional courses, which prepare the student for specific fields of interest. Similarly, each school unit can promote local history through various means, in this case, digital media, and this does not exclude the possibility of pupils developing tendencies to explore the historicity of other areas. Therefore, local history can be a learning subject, since its contribution is considered to be important in the overall scheme of things. Initially, pupils show more interest in local history, as it is associated with localness and emotional closeness. It is typical that while they think they know a lot about their local area, it turns out that they know very little (Leontsinis, 1996). Local history can be used as a tool for developing historical judgment and awareness in different ways than a general history. Firstly, local history delves into social, cultural, and popular culture, folklore, and art issues much more successfully and extensively than a history course that focuses on people and the wars between them (Vaina, 1997). By learning about local history, children can make more tangible connections, they can better comprehend history in general, draw parallels and understand how it relates to real-time and space. Hence, the need to integrate local history into General History either on a spatial or a temporal axis. In addition, students can form a view of the present, especially concerning the field of Industrial Culture, as it is more 'contemporary' and also connecting past and present is easier to happen since many industrial elements still coexist with the temporal elements and still shape the character of the place. At the same time, young people can better understand the people who inhabit the place. Involving children in their local history creates a sense of belonging and intensifies the need to participate in the community, in such a way that can lead to the formation of active citizens who are aware of issues affecting the local community.

2.2 Digital games in education

Digital Game-Based Learning (DGBL) promotes learning through a digital game, and this technique enables students to act within the game environment and acquire knowledge more enthusiastically. Supporters of DGBL

contend that it provides learning opportunities that engage students in interactive learning experiences and helps them prepare to actively participate in the globalized, technological society of the 21st century (Coffey, 2009). Drawing from the constructivist theory of education, DGBL combines educational content with a computer or video games and can be used in almost all subjects and skill levels. An “educational game” is the kind of game that is used primarily for teaching purposes and as result, today, there is a significant number of teachers and researchers who support the educational benefits of educational games.

In Game-Based Learning, the ideas are visualized and they can be understood by students better when they act like players in a game, than watch as spectators (Gee,2007). For that reason, an educational digital game creates an engaging environment, enriched by the use of multimedia, in which children can think, understand, and easily perform things. Therefore, digital games can be used as an alternative way of teaching. Some of the learning principles are directly related to all kinds of games (especially digital ones), and these are a) Interaction, b) Creativity, and c) Experiment.

According to Gee (2009), digital games provide a continuous learning environment through the attractiveness and entertainment they provide to their users. Children, like all people, are full of curiosity and they love to learn at any time, especially when they are not forced to do so. Games are a way of attracting students and motivating them to learn pleasantly; modern computers and video games provide young people, with such learning opportunities in a very short time, considering that one single click or the touch of a button takes mere seconds (Prensky, 2007). Educational games put students in the center of the learning process, which results in making this kind of learning easier, more interesting, and more effective. Some teachers, in addition, consider that Game-Based Learning is a solid educational approach (von Wangenheim & Shull, 2009). Digital Game-Based Learning (DGBL), is a learning approach that involves the use of computers and digital games for exploring and practicing educational materials. The creation of an educational game is not only for entertainment purposes, but it also focuses on the acquisition of knowledge and skills for situations that are not strictly game-related, but they focus on the course's learning objectives (Sarlis, 2018).

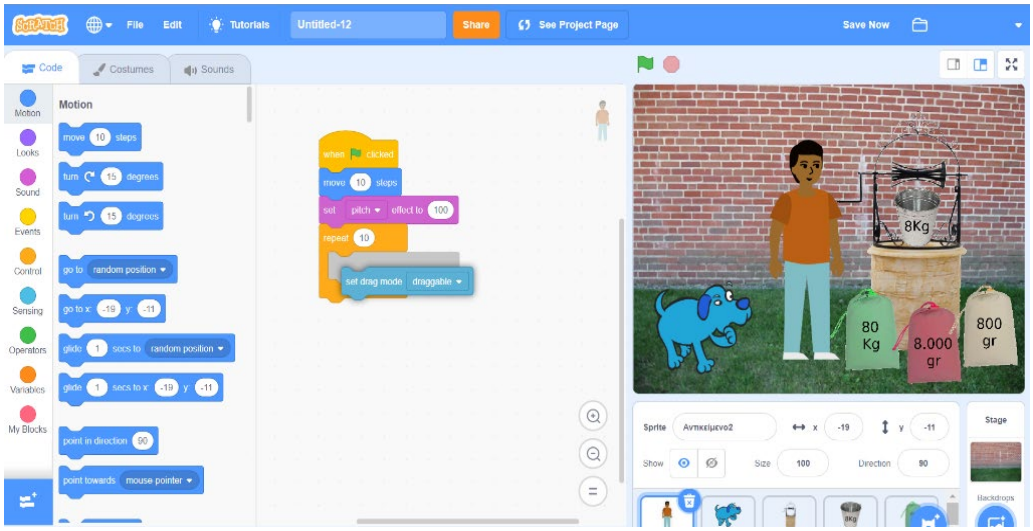

Figure 2: Development of the educational cultural game through M.I.T. Scratch Platform

3. An educational cultural game for Industrial Heritage of Drapetsona

Drapetsona is a popular district whose character has been determined by two factors: the refugee flows and industrial activity. These two factors shaped the general landscape and what formed around them, namely the workers' houses, the rebetiko music, and the inhabitants' militancy, which appeared either as an attempt to protect the housing issue or as an attempt to improve their working conditions. The remaining industrial monuments in the area serve as a 'seal' of the above; historical events that defined the area, along with the workers' housing, of course. It is therefore considered necessary to pass on to new generations the importance of the need to protect, preserve, maintain, save and promote them. It is important to make efforts for the Industrial Heritage of Drapetsona to become public property, i.e., for this game to be a place of shaping the consciences of young people. Contact with culture should not be a privilege that only a portion of the population enjoys, who are more "sophisticated" or have a penchant for "literacy", but it must be acquired by the new generation of all social and economic backgrounds and all inclinations.

The present game (Fig 2) however, is not intended to be used during the educational process, in the classroom, or as an optional exercise for children, but mainly as an optimal recreational choice for children or adolescents, to familiarize themselves with cultural heritage in general and the industrial heritage of Drapetsona in particular, while at the same time contributing to the skills that the school environment attempts to cultivate. As such, its pedagogical and cultural character does not directly concern the teaching process but it does assist it in an optional and complementary way. Some studies have also shown the positive impact that digital games seem to have on cognitive development and visuospatial skills (Ferguson, 2007). Unsurprisingly, concerns about their use have also been expressed, but these are not relevant to this particular game because they mainly relate to digital games that present violent, aggressive, and/or racist and sexist behaviors (Barlett et al., 2009). The most important feature of the present game is the possibility it offers children to visit environments and experience older landscapes, which could not have been possible in any way other than through digital play (Dillenbourg, Schneider, & Synteta, 2002; Shaffer et al., 2005; Whitton, 2007).

The main underlying questions of this research concern digitality and how it serves the two fields of culture and education. In regards to the field of Culture, the first question is about the extent to which digital games, tools, and digitality, in general, can capture and highlight elements that are historical, ethnographic, sociological, anthropological, cultural, etc. The second question relating to culture is whether digital games can raise awareness among the younger generation about issues relating to cultural heritage, and finally, whether digital games can enhance local identity. In regards to the field of Education, the first question is to what extent and in what form (in the classroom or as an obligatory or optional activity at home, etc.) do digital games assist and complement the educational process. Finally, to what extent do they contribute to the development of the child's or adolescent's cognitive skills, such as logical, mathematical, linguistic, historical, environmental, etc.

This research presents a digital educational construction that focuses on an individual case, that of the Industrial Heritage of Drapetsona. This digital construction will be in the form of a game, which will collect, transfer and process elements that will capture and highlight the cultural heritage of Drapetsona, focusing on its industrial remains and will be addressed mainly to people aged 8-18 years old. This educational game aims to develop logical, mathematical, linguistic, and other skills in children by introducing them to the landscape while emphasizing its industrial heritage and remains.

Figure 3: The category classification of the educational cultural game

The educational game is a point-and-click puzzle game with multiple character control. It is aimed at students ranging from 8 to 18 years old, with graded difficulty depending on the age of the player, making it interesting and attractive for everyone. A prerequisite is the availability of access to moderate technology. The first thing that needs to be stated is the type of game, and that is because educational games should attract the interest of students in the same way that any video game would. This educational game is classified into the following categories (see Figure 3):

- Puzzle platformer. The player tries to overcome obstacles and get to the exit from one screen and advance to the next one, using the game's mechanisms.
- Adventure. The player assumes the role of a protagonist in an interactive story driven by exploration and/or puzzle solving. The game's focus on narrative, allows it to incorporate many elements from other narrative-based media, literature, and film, covering a wide range of literary genres.
- Storytelling. The main issue is the story. Actions and activities must be part of the narrative. But the player can influence the parts that are important to the development of the game and the story.

- Logical Thinking. The game contains mini-games of sequencing, grouping, and matching. The setup, rules, and questions vary in complexity and difficulty.

To clarify the genre, the game is also classified into sub-genres (see Figure 4):

- Casual game. A simple video game that is easy to play.
- Educational game. Intentionally designed for educational purposes. Aims at helping people understand concepts, gain knowledge and develop problem-solving skills as they play.
- Critical thinking game. Players are confronted with complex problems for which they must find solutions and take appropriate action.
- Exploration. Exploring an environment and discovering a narrative about the game. A similar subcategory is a trial-and-error game, i.e., a game that requires a problem-solving method in which multiple attempts are made to reach a solution. It is a basic learning method that virtually all organizations use to learn new behaviors. Trial and error are the tests of a method, observing if it works and if it doesn't work prompts us to try a new approach.

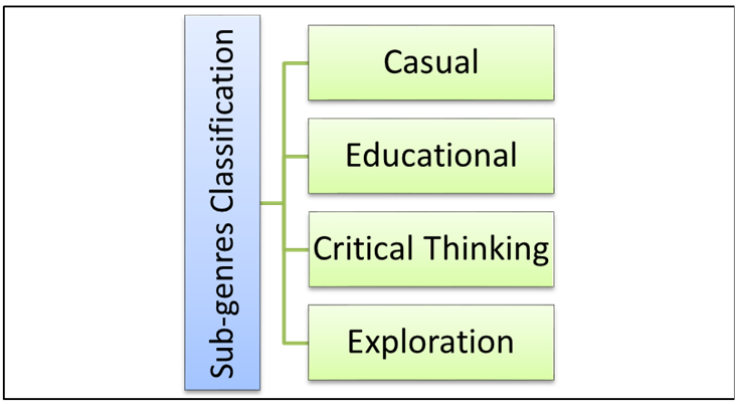

Figure 4: Sub-genres classification of the educational cultural game

The player's objective is to save landmarks in the area. There are two main characters, a boy with his pet and a non-player character. The boy wakes up on an ordinary day and realizes that some of the city's landmarks and industrial monuments have disappeared. At the same time, he realizes that all the townspeople have forgotten that they ever existed and do not remember their history, as if someone has erased their memory. There are three modes: inventory, map, and game. In inventory, he keeps all the items he collects that will be needed to solve one of the subsequent puzzles. The map shows the points that need to be saved and they are depicted as blurry. When the player restores the point, the corresponding point on the map becomes unblurred and the player proceeds through the map to the next point that needs saving. The theme of the game is inspired by the history of the industrial culture of Drapetsona. The locations where the game takes place correspond to real places in Drapetsona, they are thematic and can be either indoor or outdoor. Examples of such places are the Glassworks, the Fertilizer factory, and the Labor - Refugee housing.

It seems appropriate to mention some of the game's features. There is no main menu. The game starts with an introductory narration of the story through a video with no voiceover. The game sequence is semi-linear. This means that the actions required for the boy to advance to the next point on the map are predetermined and are not influenced by the player's will. However, because the actions could be performed in a different order, they cannot be characterized as linear, but semi-linear. In terms of players, the game features multiple character control. Each of the two characters has their skills. For example, the child lifts objects with his hands but cannot jump, while the pet cannot open something, but jumps on surfaces, such as shelves, that are high up. There are also non-player characters who help either in terms of solving the puzzles by giving clues or information about a specific part of the city. The player interacts both with the environment and the non-player characters. The visuals are the third person’s point of view. The game is a point-and-click, which means that the player only needs to operate the computer mouse. He clicks on objects to move them, lift them or climb on them. In the mobile version of the game, the logic is the same. After each mission's fulfillment and before the player moves on to the next screenplay, a cut scene is inserted that presents a visual 2D narrative that contributes to the story's plot progression. The game contains Mini games, such as hidden objects, tile-matching, and text puzzles that will be integrated for the boy to receive an object he found and place it in the inventory. To avoid points

where the player gets stuck and frustrated there will be Hints by pressing a button located at the bottom right of the screen, which will make an object glow to indicate to the player what his next move will be.

4. Game semantics

The boy's effort to save people's memory is equivalent to the actual effort of saving historical memory by preserving the industrial heritage of the place. It is important for education to ensure that young people are informed and sensitive to cultural heritage issues. The purpose of the game is therefore identical to the ultimate goal of raising awareness among children and adolescents about the preservation, conservation, and promotion of cultural heritage. The game challenges students to save the place and more specifically to save the memory of local history. This in itself puts the student in a position to defend and protect the historicity of the area and to feel responsible for it. This creates a sense of place, a sense of belonging, and an awareness of the public space. These feelings are deliberately evoked to lead them to search for their local and social identity, which they will find through historicity. A prerequisite for satisfying the feelings for the place created by the digital game is the knowledge of history and the exploration of the place. This purpose is served by the game levels, whose graphics correspond to the past and present character of the place, and the challenges that the player is required to face are related to actual challenges, whether present or past. Information and knowledge are also provided by cutscenes referring to the place and its history, as well as by the non-player characters with whom the player interacts.

Table 1: Examples of puzzles of the educational cultural game for an industrial urban landscape

Examples of puzzles		
Field	**Puzzle**	**Solution**
Mathematical and Environmental Skills	They need water from the well to water the Fertilizer trees, but they cannot lift the bucket of water. At the end of the rope is another empty bucket with 8kg of water.	Somewhere on the screen, there are 3 sacks and each of them says 8,000gr, 800gr, and 80kg. They have to place the correct sack in the bucket so that the bucket of water rises to the desired height. If they go with the wrong sack, the bucket of water will either rise too low or too high.
History Review Skills	To unlock a padlock, they have to write the date of the foundation of the municipality of Drapetsona.	First, click on the padlock and then type the 4 consecutive numbers until the desired answer is formed.
Linguistic Skills	They have to open a locker that says "When?" and has 3 sentences underneath.	They have to find the tenses of the 3 sentences to open the cupboard.
Engineering/ STEM Skills	They have to reassemble a broken machine.	Moving levers, moving pieces, etc.

These allow the players to search for further information on their own or in cooperation with their classmates - teammates or the teacher who stands by to assist in this whole process of discovery. In addition to guiding and solving questions about the history of the place, the teacher can also assist with the other skills that the game claims to foster, such as ecological awareness or solving a mathematical problem. These can also serve as an opportunity to broaden the dialogue beyond local history to general history or the current cultural, industrial, political, etc. scene. Furthermore, the digital game is an opportunity for pupils to visit local places, listen to relevant music, or collect folklore and historical oral information from their grandparents.

The map functions as a spatial introduction to the place and teaches the player to identify the locations of current industrial sites, industrial monuments, and industrial sites that have been demolished and their physical traces no longer exist. Each time players try to save a digital industrial landscape, in addition to being entertained, they receive information about that landscape in many ways. First, through the image where they see certain features of the industrial facility. Then, they receive information through the puzzles which in some cases may be about the industrial facility itself, for example, the restoration of a machine that was part of the factory's equipment for the production of the product. Finally, they receive information through the cutscenes that each time provide clues and images that make up the whole story of the game, which is none other than the industrial history of the place. As the purpose does not focus on a specific field, but on a wide range of aspects of education, in addition to the objective of raising awareness, informing, and assisting the player in the protection of the industrial heritage, the game also aims at assisting children's other skills related to the

educational process. In particular, there are puzzles to be solved, which require and also help to develop students' mathematical, logical, linguistic, historical, and environmental knowledge and skills. Indicative examples of such puzzles are shown in Table1.

5. Next steps - conclusions

5.1 The evaluation of the game

The construction of the described digital game is still in progress; thus, we will attempt to present the evaluation plan that will be implemented after its completion. Initially, three high schools in Drapetsona will be selected, where questionnaires will be distributed to the students which will test their knowledge and interest in the history of the place in general and the industrial heritage in particular.

Table 2: Questionnaire A (before game distribution)

Questionnaire A (before game distribution)	
Closed type questions	**Answers**
How often do you visit the Fertilizer Space?	Often/sometimes/rarely/never
Do you know where the name comes from?	Yes/No
Do you know what the Bridge of the Rebbe is?	Yes/No
Are you familiar with the poem Drapetsona by Tasos Livaditis?	Yes/No
What feelings do you have about the Oil One operation?	Neutral/negative/ positive/I don't know
Open type questions	
What do you know about the battle of electricity?	
What do you know about the shack battle?	
What do you know about the refugee issue?	

Table 2: The Questionnaire B (after-game distribution)

Questionnaire B (after game distribution)	
Closed type questions	**Answers**
The game was easy	Yes/No
I had fun playing this game	Yes/No
I would like to play again this game	Yes/No
The game was interesting	Neutral/negative/ positive/I don't know
I had difficulties playing this game	Neutral/negative/ positive/I don't know
Open type questions	
What do you know about the battle of electricity?	
What do you know about the shack battle?	
What do you know about the refugee issue?	

The game will then be distributed to these high schools, not as a compulsory task, but as an optional activity for one month. The teachers in charge will be history majors, who will have to agree to devote one hour a week - 4 hours in total - to solving questions or discussing the issues addressed by the game. At the end of the implementation month, two types of questionnaires will be distributed (see Tables 2 & 3). One questionnaire will be addressed to the pupils and will contain the same questions as those mentioned in Table 2, to examine the extent to which the game has contributed to the pupils' knowledge of local history. It will also include some additional questions asking for their impressions of their experience of the game and suggestions for improvement, additions, and changes. It will primarily examine whether the desired feelings and interests were evoked in the students. The second questionnaire will be addressed to the teachers and will examine their observations on the student's interest in Drapetsona and its history in general, as well as its industrial heritage in particular. It will also assess the contribution of digital media to the educational process. The questionnaire will revolve around the following questions:

- Did the children show interest in local history?
- Did they show interest in the industrial heritage?
- Was there fruitful dialogue in the classroom?
- Were they challenged/sensitized?
- How do you think digital media contributed to the process?

Conclusions will be drawn by comparing the pre-game questionnaires with the post-game ones, as well as from the teachers' evaluations. In this way, the extent to which students gained knowledge about local history and industrial heritage and whether they liked the way that it was accomplished, i.e. the digital game, and to what extent they reflected on it, will emerge.

5.2 Added value

It is widely accepted that video games have become a key part of people's everyday lives, especially younger ones. Their widespread acceptance and appeal have been followed by their introduction into education since they motivate players to achieve certain goals through their interaction in a rule-based environment. Culture and Education have the common goal of improving people's lives through knowledge. Therefore, Education that focuses on Cultural Heritage can help in understanding history, arts, literature, and society, at large, by fostering in students the value of respect and acceptance of diversity (Luigini, Parricchi, Basso & Basso, 2020). Furthermore, it shapes the future generation of informed, cultured and active citizens who, beyond the often-sterile knowledge imparted by the school, acquire sensitivities and reflections with a positive connotation. The added value of this article lies in the presentation of an innovative application that will pique the interest of young people in matters of industrial heritage. It stresses the importance of place in the educational process and proposes the cultivation of cultural awareness at a young age. Finally, it serves as an incentive for the construction of similar games concerning other places and perhaps other types of local cultural heritage beyond the industrial one.

5.3 Suggestions for future research

The findings of this study can be used to build games in areas that have a rich industrial heritage and there is a need to raise awareness about their conservation. We suggest that this game should be implemented by teachers of the school units in Drapetsona. After the conclusions of this research, it will be possible to finalize the game, but it will also provide guidelines for the construction of games related to and inspired by the cultural heritage of other areas, without excluding the use of the game by the residents of other places.

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References

Barlett C P. , Branch O. , RodehefferC. , Harris R. (2009) "How Long Do the Short-Term Violent Video Game Effects Last?" in *Aggressive Behavior* Vol 35 pp. 225-336 Retrieved 10-5-2022 from http://citeseerx.ist.psu. edu/view doc/download?doi=10.1.1.1040.3690&rep=rep1&type=pdf

Coffey, H. (2009). *Digital game-based learning.* Chapel Hill, NC.: the University of North Carolina at Chapel Hill School of Education.

Dillenbourg P., Schneider D., Synteta P., (2002). Virtual Learning Environments. 3rd Hellenic Conference “Information & Communication Technologies in Education”, Rhodes, Greece. pp.3- 18. final-00190701

Ferguson, C. J. (2007). Evidence for publication bias in video game violence effects literature: A meta-analytic review. *Aggression and Violent Behavior, 12*(4), 470–482. https://doi.org/10.1016/j.avb.2007.01.001

Gee, J. P. (2007). *What video games have to teach us about learning and literacy* (2nd ed.). New York: Palgrave Macmillan.

Gee, J. P. (2009). Deep learning properties of good digital games: How far can they go? In U. Ritterfeld, M. Cody, & P. Vorderer, *Serious games: Mechanisms and effects* (pp. 67–82). New York, NY: Routledge.

Geospatial Enabling Technologies (2021). "Urban planning application of the Municipality of Keratsini-Drapetsona". Retrieved 10.5.2022 at https://www-getmap-eu.translate.goog/project/gis-keratsini/?_x_tr_sl=el&_x_tr_tl=en

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. International journal of research in education and science, 1(2), 175-191.

Guy, J. S. (2019). Digital technology, digital culture, and the metric/nonmetric distinction. Technological forecasting and social change, 145, 55-61.

Hsu, J (2008). The secrets of storytelling. Scientific American Mind, 19, 46-51

Husbands, C., Kitson, A., & Pendry, A. (2003). Understanding history teaching: Teaching and learning about the past in secondary schools. McGraw-Hill Education (UK).

Jenkins, H. (2004). Game design as narrative architecture. In N. Wardrip-Fruin & P. Harrigan (eds.), First Person: New Media as Story, Performance, Game. Cambridge: MIT Press.

Koster, R. (2005). A Theory of Fun for Game Design. Scottsdale, Arizona: Paragylph Press.

Leontsínis, G. N. (1996). Didactic of History: general, local history, and environmental education.

McGonigal, J. (2011). Reality is broken: Why games make us better and how they can change the world. Penguin.

Michael, D. & Chen, S., (2006). Serious Games: Games that Educate, Train, and Inform. Boston: Thomson Course Technology. Michael, D. & Chen, S., (2006). Serious Games: Games that Educate, Train, and Inform. Boston: Thomson Course Technology.

Moira, P., Papachristopoulou M., Mylonopoulos, D., Parthenis Sp. (2009). *Industrial Heritage Tourism as a Special Interest Tourism Form. The Case of the Prefecture of Magnesia in Greece*. 10th International World Cultural Tourism Conference 2009, pp. 479-493, Bangkok, Thailand.

Prensky, M. (2007). *Digital Game-Based Learning.* MN: St. Paul, Paragon House.

Robins, A., Rountree, J., & Rountree, N. (2003). Learning and teaching programming: A review and discussion. *Computer Science Education*, pp. 13. 137-. 10.1076/csed.13.2.137.14200.

Sarlis, I. K. & Zacharias, P. (2018, 6). *Development of an Adventure Game for Learning Programming and Coding in LOGO.* Retrieved 6 20, 2019, from Open University of Cyprus - Kypseli Digital Repository:

Takeuchi, I. & Vaala, S. (2014). Level up Learning: A National Survey on Teaching with Digital Games. New York: The Joan Ganz Cooney Center at Sesame Workshop. Retrieved 16-4-2022 from https://www.joanganzcooneycenter.org/wp-content/uploads/2014/10/jgcc_leveluplearning_final.pdf ?msclkid=6ded7d77cf1611ec8612808091e31562

The International Committee for the Conservation of Industrial Heritage (2022). "Welcome". Retrieved from: https://ticcih-gr.translate.goog/?_x_tr_sl=auto&_x_tr_tl=en

Vaina, M. (1997). The theoretical framework of local history teaching for the 21st century, Gutenberg, Athens.

von Wangenheim, C. G., & Shull, F. (2009, March). To Game or Not to Game? IEEE Software, 26(2), pp. 92-94.

Whitton, N. (2007). Motivation and computer game-based learning. In *Proceedings of ASCILITE - Australian Society* for *Computers in Learning in Tertiary Education Annual Conference 2007* (pp. 1063-1067). Australasian Society for Computers in Learning in Tertiary Education. Retrieved May 9, 2022, from https://www.learntechlib.org/p/46185/.

Williamson, D., S., Kurt R. S., Halverson, R., Gee J. P. (2005) "Video Games and the Future of Learning" First Published October 2005, Research Article https://doi.org/10.1177/003172170508700205

Problems and Opportunities of Distance Learning in the Context of the Pandemic: Case of one University in Kazakhstan

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Abstract: Distance education systems are being actively studied and developed in higher educational institutions of Kazakhstan and have already passed the path from the distance learning system to Intelligent flexible learning model based on Web technologies. The advantages of online learning are classroom and platform independence. The goal of various intelligent learning systems is to use knowledge about the field of study, the learner, and learning strategies to provide flexible, individualized study and training. Many Kazakhstani universities were engaged in distance learning as part of the implementation of the second higher education. Obtaining a second higher education in Kazakhstan refers to studying in higher education programs after completing studies at the first higher education in the form of a bachelor's or specialist's degree. By obtaining a second higher education, you can get a degree or qualification in another educational program. The purpose of this empirical research is to study the attitudes of students regarding distance learning and to identify problems in the fulfillment of distance learning in an emergency transition. The study uses a quantitative research method based on a one-dimensional data analysis using descriptive statistics. In order to assess the level of distance learning organization process, the institutional study was initiated at the Kazakh National Women's Teacher Training University and conducted by the Research Institute for Social and Gender Studies. Based on this study recommendations were developed to improve the educational, methodological, social and educational work of the university, including the use of library resources in the conditions of distance learning. The study was conducted during June - July 2020. The study involved 677 students from all faculties of the university, including bachelor and master degree students, doctoral students. The study was prompted by: the need to assess the quality and level of organization of distance learning at the university; the need to identify problems (issues) of educational and social adaptation of the first-year students; the need to establish the degree of satisfaction of students with the distance learning process. The survey also allows to determine: the most effective forms of distance learning; study the performance indicators of the services provided by the university; to study the indicators of adaptation of students, master degree and doctoral students (satisfaction with the results; deficit experienced by students); evaluate the effectiveness of the work of deans, teachers and advisors from among teachers from the point of view of students. This research identifies the problems in the transition from traditional to distance learning and difficulties that arise when students receive high-quality professional education. Recommendations are developed to optimize the work of university structures aimed at improving the efficiency of the institutes' work and psychological services. The results obtained will make it possible to make managerial decisions based on information that considers the opinion of consumers of educational services.

Keywords: distance learning, COVID-19, pandemic, Kazakhstan, institutional research, educational and methodological work

1. Introduction

The COVID-19 has caused unprecedented changes in human history, including digital, managerial and organizational transformation due to the transition to remote work. On March 11, 2020, the World Health Organization declared a pandemic of a new type of coronavirus COVID-19. In accordance with the recommendations of the World Health Organization (WHO), one of the important measures to prevent the spread of COVID-19 is to reduce physical contact. Transition to distance learning has begun. The forced transition of Kazakhstani and other educational institutions all over the world to distance learning due to the COVID-19 pandemic has shown an urgent need for a "digital transformation" of education. The pandemic has actually increased the demand for distance education and has become a catalyst for the development of online learning. The urgency of distance learning in 2020 came as somewhat of a shock for the population and government agencies in most countries of the world.

In such an emergency, the Kazakh National Women's Teacher Training University, like other universities in Kazakhstan, also switched to distance learning during the pandemic. Under quarantine conditions, educational

institutions were faced with the task of maintaining the health of students and faculty, without interrupting the learning process. During distance learning, educators at Women's Teacher Training University used virtual learning environments such as Zoom, GoogleHangoutsMeet, Skype, MicrosoftTeems and other means of information. Extensive electronic library resources were also available for students. In June-July 2020, a sociological study was conducted at Kazakh National Women's Teacher Training University, in Almaty city. The purpose of the study was to study the attitude of undergraduate and graduate students regarding distance learning; identify the problem of implementing emergency transition to distance learning.

This article attempts to systematize the areas of digitalization of higher education, determine their impact on the content and results of students teaching, and outline a program for studying the social risks of transforming higher education, as a social institution, under the influence of digitalization. In particular, the digitalization of higher education means the transformation of the educational and management process, everyday social practices in the higher education system, due to the introduction of technologies for creating, processing, exchanging and transmitting large amounts of information on non-paper carriers. Digitalization involves the integration of education with information resources (Minina, 2020). The paper includes three sections. The first one determines the effectiveness of the work of deans, teachers, advisers (educational and methodological work). The second section describes additional information on the organization of library services in the context of remote work to further improve the quality of library services, as well as to increase the scientific level of the university library. The third section presents social and educational work, since social work at the university is very important. By examining the differences in how learners use the Internet to search for information, we can determine if there is a “level two digital divide” in the process of formation (Hargittai, 2002), since the Internet is widespread for most learners. To investigate this issue, we report the results of a study that examines the ability of learners to find information on the Internet. Documenting differences in Internet usage skills allows us to identify how different learners can take advantage of this environment in different ways. Using the Internet for distance education requires more planning and preparation than any other form of education. The preparation of materials and programs using these materials is an important part of education. And also, in distance learning, various educational software tools are used that create electronic educational complexes. The research results allowed us to develop recommendations on how to improve the educational, methodological, social and educational work/process of the university, including the use of library resources in conditions of distance learning.

2. Literature review

Most of the literature reporting the spread of the Internet focuses on the differences between those people who have access to the Internet and those who do not, or the differences between those who use it and those who do not. And also, literature analyzes the benefits of digital technologies in higher education (Kurmangulov et al., 2017; Sappey, Relf, 2010; Dabbagh, Kitsantas, 2012). Research on the development of digitalization in general and distance learning, and in particular in higher education, has been updated in the last two decades. These problems were actively developed by R. Garrison, who pointed out the main disadvantage of distance learning, which is the lack of its theoretical framework and foundation (Garrison, 2000). Other researchers T. Nikulina, E. Starchenko analyzed the advantages of distance education for students: learning at any convenient time, continuous education, the ability to design individual educational paths, etc. (Nikulina, Starchenko, 2018). M. Balykhin in his article considers perspective directions and problems of development of e-learning" (Balykhin, 2008). Authors in the work "New pedagogical and information technologies in the education system" provide an analysis of digital education, its structure, and the nature of the interaction between teachers and students in higher education (Polat et al., 2008). The technical difficulties of distance education are studied by D. Pyari, S. Jarmon, A. Smirnova and other authors (Pyari, 2011; Jarmon, 1999; Smirnova, 2015 et al.).

Distance education and learning came out as the result of the development of technologies associated with the Industrial Revolution in Northern Europe and North America in the late eighteenth and early nineteenth centuries (Keegan, 2002). The theory of distance learning as the most industrialized form of teaching and learning was developed by Peters (1994), who was to become the first rector of the Distance University in Hagen (Peters, 1994). In the model, developed in the mid-1960s, Peters analyzed the structure of distance education and noted the possibility of introducing industrial production methods such as division of labor, mass production and organization to achieve economies of scale and reduce unit costs. From Peters' point of view, self-learning and distance learning are very autonomous approaches to learning (Peters, 1994). The electronics revolution of the 1980s led to group distance learning and opened the door for the network and Internet access.

3. Method

The study used a quantitative research method based on a one-dimensional data analysis using descriptive statistics. For quantitative research we used the questionnaire method with a sample size of 677 respondents.

Univariate analysis is the simplest form of data analysis. "Uni" means "one", in other words, the data has only one variable. It does not deal with causes or relationships (unlike regression) and its main purpose is to describe. It uses data, summarizes that data, and finds patterns in the data. The task of one-dimensional descriptive analysis is to compress the information received, to present it compactly for further understanding. Like all other data, one-dimensional data can be visualized using graphs, images, or other analysis tools after the data has been measured, collected, compiled, and analyzed.

During the study, 677 students from various areas of education (of which from the Faculty of Pedagogy and Psychology - 109 students, undergraduates, doctoral students; from the Faculty of Physics, Mathematics and Computing - 123; from the Faculty of Social Sciences - 58; from the Faculty of Kazakh and World Languages - 85; from the Faculty of Natural Sciences - 293; from the Faculty of Arts and Humanities - 9 students, undergraduates, doctoral students), who had experience in distance learning during the pandemic, were interviewed.

4. Results and discussion

The study involved respondents from 6 faculties of the University: Faculty of Pedagogy and Psychology, Faculty of Kazakh and World languages, Faculty of Natural Science, Faculty of Physics, Mathematics and Computing, Faculty of Social Sciences, Faculty of Arts and Humanities (starting from fall term 2021-2022 academic year University has 5 faculties, and they are called Institutes). The average age of the respondents ranged from 18 to 22 years (Figure 1). The percentage of the age groups is distributed as depicted on Figure 1.

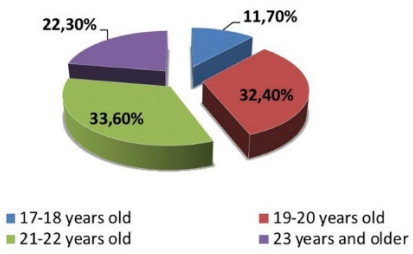

Figure 1: Age characteristics of students

According to the levels of study, the respondents are distributed as follows: 73.2% - undergraduate students, 21.3% - master students, 5.5% - Ph.D. students. The general distribution of respondents by faculties is presented as follows

- Faculty of Pedagogy and Psychology - 16.2%;
- Faculty of Kazakh and world languages - 12.6%;
- Faculty of Physics, Mathematics and Computing - 18.2%;
- Faculty of Natural Science - 43.1%;
- Faculty of Social Sciences - 8.6%;
- Faculty of Arts and Humanities - 1.3%.

Evaluation of educational and methodological work and satisfaction of students

The first section of the study is to determine the effectiveness of the work of deans and academic staff (teachers). As the results of the study showed, students are involved in various forms of self-training: 8.5% of respondents more often use the form of home (domestic) study with the help of printed teaching materials, 9.7% of respondents are involved in self-study in the library. The largest number of students use the form of self-study, carried out with the help of Internet technologies - 42.4%, electronic resources are used by 39.4% of respondents. According to the results of the survey, digital technologies are actively and widely used by students in the educational process (Figure 2). Analyzing the respondents' answers, we see the priority of Internet

technologies in the process of performing self-study assignments. We can suggest that students rarely and at a very low level use the traditional method of self-study and self-training with the help of printed teaching materials. Electronic resources (mainly electronic textbooks) are also significant for the self-study process. These self-training forms greatly facilitate the process of distance learning due to its mass accessibility.

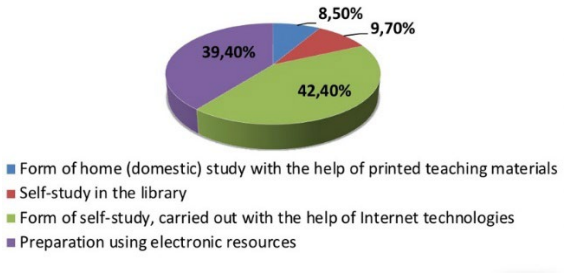

Figure 2: Forms of self-training of students

The results of studying the attitudes of students to distance learning (education) in the context of a pandemic in Kazakhstan showed that 52.2% of respondents point out that the learning process in the traditional way (classroom learning) is more interesting due to direct and interactive communication with teacher and classmates. 18.6% of students believe that distance learning contributes to the socialization of individuals, 10.7% of respondents claimed that spare-time (leisure time) is reduced in the process of distance learning, according to 16.4% of respondents, distance learning requires the development of digital skills, and only 2.1% of students prioritize the traditional education system (Figure 3).

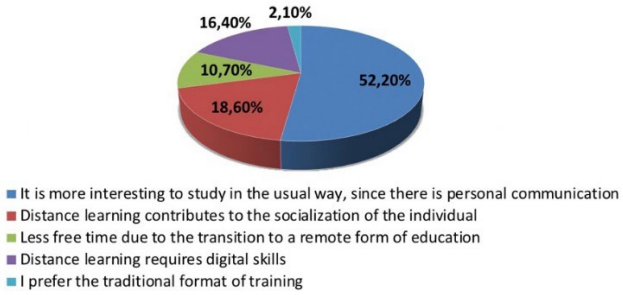

Figure 3: Attitude of respondents to distance learning during the pandemic

Authors identified the main factors hindering the effective use of distance learning technologies at the University by studying the attitude of students to the process of organizing distance learning at Kazakh National Women's Teacher Training University. 35% of students pointed out the lack of educational and methodological materials for on-line and off-line learning, 27.9% - insufficient technical equipment of the educational process, 20.3% - insufficient level of teachers' knowledge of information and communication technologies and 16, 8% - other reasons (Figure 4).

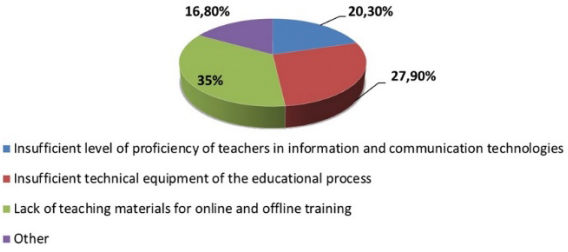

Figure 4: Factors hindering the effective use of distance learning technologies at the Kazakh National Woman's Teacher Training University

The survey results showed that the main problem faced by students (62.6% of respondents) in the course of distance learning is technical problems (low speed and quality of the Internet, errors in the operation of

hyperlinks). 12.7% of students from remote villages have limited access to the Internet, 11.9% of students do not have their own computer (laptop), 10.2% of respondents note an increase in workload and lack of time for self-study due to the transition to distance learning. 2.6% of respondents point to the absence of the Internet in remote rural areas (Figure 5).

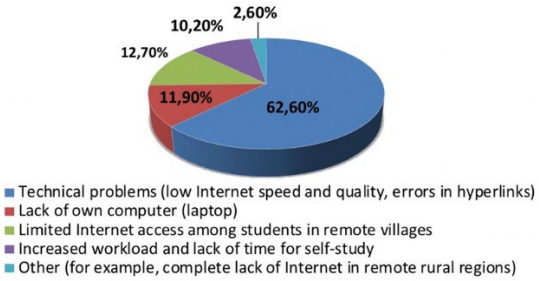

Figure 5: Problems during the organization of distance learning at the Kazakh National Woman's Teacher Training University in the conditions of emergency transition to remote mode

Findings:

With a mixed form of classes, the amount of work performed is practically divided between the student and the teacher.

It is recommended to study in more detail the factors hindering the effective use of distance learning technologies at the university and to develop measures to provide students with educational and methodological materials necessary for the effective organization of the learning process in on-line and off-line modes (35% of students note the lack of educational - teaching materials).

The results of the survey showed that the main problems of distance learning are technical issues. Firstly, there were problems with communication, secondly, unfortunately, not all teachers and students had graphic tablets that allow them to instantly write the necessary answers, explanations, etc., thirdly, psychological separation from the teacher, contactless education demotivated, in some cases, and lost interest in learning. In addition, not all sites work stably and reliably, and this only adds stress.

Regarding the emerging technical problems, of course, it is necessary to consider and refine, the university needs to prepare more stable and reliable platforms for conducting such classes. Good technical equipment is needed: a computer and Internet access (as technical problems, 62.60% of students noted the low speed and quality of the Internet, errors in the operation of hyperlinks).

And also take measures to improve the qualifications of the teaching staff in the field of using distance learning technologies in the educational process (20.3% of students note an insufficient level of knowledge of information and communication technologies among university teachers), to promote the sufficient development of communication technologies by the teaching staff.

Develop detailed video instructions, recommendations on the use of specific applications for mastering educational material, social networks, video broadcasts for teachers and students.

The university needs to organize a rapid exchange of experience of teachers through video conferences, webinars, video tutorials on the use of various services and environments, conducting training sessions, organizing independent work of students, etc.

Evaluation of the work of the scientific library and satisfaction of students

The survey was conducted among university students in order to obtain additional information on the organization of library services in the conditions of remote work for the further improvement of the quality, as well as raising the scientific level of the university library. The results of the survey showed that 30.19% of students use the services of the library 1-2 times a week, 41.94% of respondents less than once a week, 17.85%

of respondents go to the library 1-3 times per month, 10 .02% claimed that they use the library on a daily basis (Figure 6). More than a third (41.94%) of all respondents very rarely or never use the services of the library.

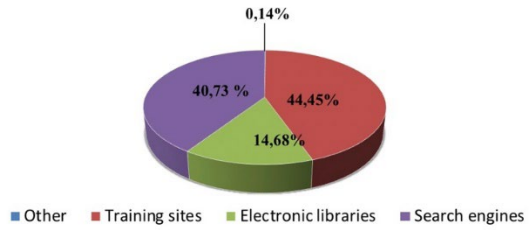

Figure 6: The most popular information resources

According to the results of the analysis, 29.96% of university students prefer library services for training in working with library information resources, provided in the form of individual consultations, 22.57% of respondents are interested in group trainings, 27.44% online consultations, 9.13% master classes and 10.9% webinars (Figure 7).

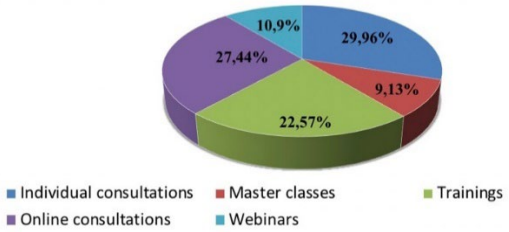

Figure 7: The most popular library services for training in working with information resources

The conducted institutional research made it possible to assess the extent to which the resources and services of the university library contributed to the educational and scientific work of students. 35.37% of students believe that library resources and services are essential and useful in the performance of educational and scientific work. 59.05% are inclined to believe that library resources and services contribute only to a small extent to the effectiveness of the educational process, and 5.29% of respondents do not consider them useful. 0.29% of respondents expressed their opinion regarding the inefficient use of library resources and services, indicating the reason for the inability to formulate formal request or due to lack of personal time (Figure 8)**.**

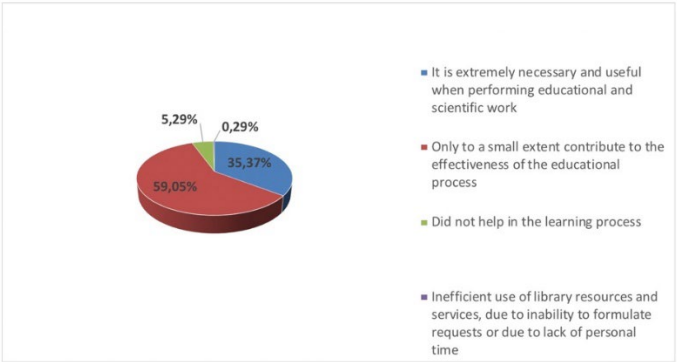

Figure 8: The importance and usefulness of the library's resources, services in the educational and scientific work of students

The study assessed the quality of library services for information retrieval (data searching) in the electronic catalog. Survey results showed that the quality of library services on information search in the electronic catalog is not satisfied with 10.46% of users, and 58.57% of respondents are satisfied with the quality of services provided. 11.65% of students indicate the drawbacks of the received information from electronic catalogs, and 19.32% note the relatively poor state of the information and electronic databases of the library (Figure 9).

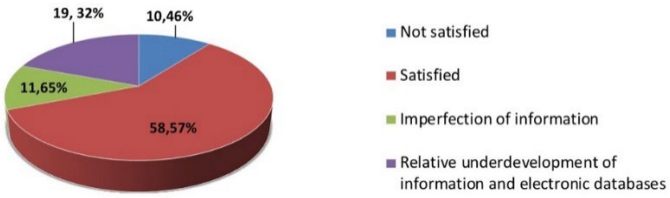

Figure 9: Perception of the quality of library services for information search in the electronic catalog

Users with low level of satisfaction of data searching service of the library indicated the following problems:

- "because it gives out a lot of unnecessary information"
- "multiple steps required"
- "not all books are listed in the catalog"
- "it is not possible to search in all databases at once"
- "inconvenient search by keywords"
- "search takes a long time"
- "need to expand search options"
- “does not have double search”, etc.

Findings:

The results of the survey highlighted several issues:

- technical problems associated with the use of existing software, service technologies, etc.
- most requests were related to the work of the Electronic Catalog of the Library, within the framework of which the electronic library of publications of the university staff also works. Deficiencies in the technical support are, for example, in setting up the interface of the Electronic Catalog, where there are headings, buttons and services that are incomprehensible to the user.
- communication in an insufficiently effective system of interaction between the library and the user.
- the lack of skills in working with resources of all categories of users, including library workers.

The shortcomings or even lack of skills in working with electronic resources among different categories of users largely depend on the library. User training is one of its main functions, the absence of a training system negatively affects the educational process as a whole, resources and services remain unclaimed. In this regard, the following recommendations were made to the university:

- 1. In order to improve service and attract users, create special sections on the website of the university library, where, using feedback forms, it will be possible to promptly study users’ opinions about the quality of services provided (41.94% of respondents do not use library services).
- 2. Improve the quality of technical support for library resources, improve the work of electronic catalogs (10.46% of users do not like the quality of library services for searching information in the electronic catalog; 11.65% of students point out the imperfection of the information received from electronic catalogs and 19.32% note relative underdevelopment of information and electronic databases of the library).
- 3. Create a convenient search mechanism (Categories of users with a low level of satisfaction indicated functional problems: “keyword search is inconvenient”, “gives a lot of unnecessary information”, “several actions are required”, “not all books are reflected in the catalog”, “ there is no possibility to search in all databases at once”, “search takes a long time”, “need to expand search options”, “does not combine double search”, etc.).
- 4. Develop interfaces that include training materials, tips, personalization options, saving search history, a convenient content format and citation tools with data upload for bibliographic reference processing programs. User should have a concise user-friendly resource interface, if some buttons and links do not work, they should not be in the interface, everything should be as simple and clear as possible.

- 5. Continue training to work with the information resources of the library, since this service is in demand among students (35.37% of students believe that library resources and services are extremely necessary and useful in the performance of educational and scientific work) and there is a need to provide additional advisory assistance to a certain category of students who do not know how to use the electronic digital resources of the library (0.29% of students do not have the skills to create queries).
- 6. Continue planned activities for training in working with the information resources of the library, paying special attention to individual / online consultations and trainings, since these forms of training are recognized by the results of the study as the most effective forms of interaction with students, which are in particular demand among library users (29.96% of students prefer individual consultations, 27.44% online consultations, 22.57% of respondents are interested in trainings).

Evaluation of the effectiveness of social and educational work in the context of distance education

Social and educational work is becoming the most important activity of educational institutions of higher professional education (Lomakina, 2014).

Social work in close connection with educational work involves the organization of interaction with students, including with their socially unprotected category, in order to identify their social and living conditions, difficulties that arise, and introduce appropriate changes and transformations into their life activities.

The evaluation of the level of students' participation in various University events (webinars, conferences, social events, etc.) was also carried out during the first stage of the transition to distance learning. As the results of the survey showed, the vast majority of students (49.85%) took part in online webinars and conferences, 23.58% - took part in public events initiated by the University, 21.14% - published information posts on their personal page, 3, 97% - took part in actions in social networks, 1.46% - did not take part in the social and public life of the University, for various reasons (Figure 10).

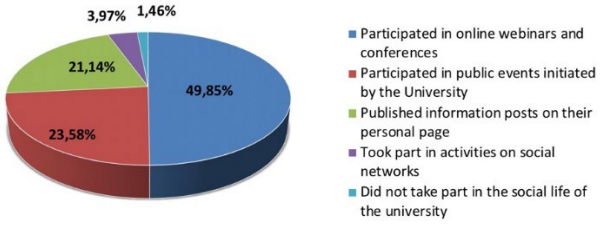

Figure 10: The level of activity of student's participation in various university events during the first stage of distance learning

Under the conditions of the remote mode of work, social work at the University was carried out in a planned manner, and events for students' leisure were organized. According to the survey results, 45.2% of students took part in Challenges, 29.07% - participated in webinars, 9.35% - in training, 1.74% - in master classes, 2.79% of students - in various student events. 1.85% of respondents confirm their participation in other events (concerts and olympiads) organized by the University for students (Figure 11).

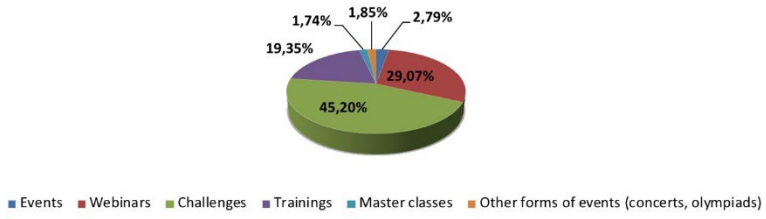

Figure 11: Participation in events organized by the University for student's leisure

In order to study the social activity of students, an analysis of volunteer activities during the period of distance learning was carried out. As the results show, among the respondents 3.6% were very actively participating in volunteer activities, 25.9% of respondents participated partially, 50.7% did not volunteer, 19.8% of respondents had no interest (Figure 12).

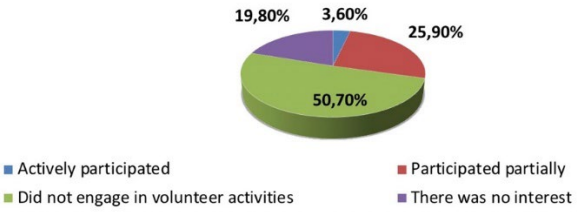

Figure 12: Social activity and volunteer activity of students during distance learning

During the period of distance learning, the main part of social work with students was carried out by (academic) advisors. Survey results of show that 23.94% of students kept in touch with their advisors in order to participate in the public life of the University, 57.93% constantly interacted with advisors in order to organize the educational process of the groups (supervisory hours, educational activities), 12.6 % - kept in touch in order to receive socio-psychological support during the pandemic. 5.23% of respondents note that parents received information about the distance learning process. 0.30% of the respondents interacted with advisors on other issues (for example, advice on exams) (Figure 13).

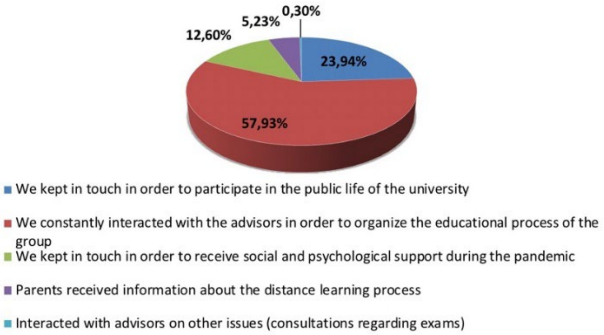

Figure 13: Forms of interaction of students with advisors during distance learning

Based on the results obtained through a comparative analysis, individual recommendations were prepared for improving educational and methodological work, improving the quality of library services at the University, improving the socio-educational work of the University, which made it possible to strengthen management and development strategies.

Findings:

In general, within the framework of organizing educational work at a distance, with the help of Internet services, a number of problems arise:

- low motivation of students to participate in educational activities. In case of classes or assignments, for not attending the lecture during distance learning or not completing the task, students receive comments from teachers and/or their parents are informed about it. To avoid bad marks or conversation with their parents, students will try to attend classes. But educational institutions cannot use those methods for attracting students to the educational and cultural activities, which have always been voluntary. Students can only be attracted to those activities sue to their content and emotionality, or the authority of the teacher;
- limited forms and methods of educational work during the distance learning (classical approaches cannot always be used using the Internet, and not everyone can convert them using a digital educational environment).

However, these difficulties can be overcome. To improve the educational work of the university, the following recommendations were developed:

- activate the action plan for the formation of students' motivation for voluntary social activities (35.99% of students did not take part in any social activities). For all responsible participants in this process (employees of the department for working with youth and public organizations, deans, heads of departments and advisers), in order to successfully conduct educational work in the context of distance learning, it is necessary to develop a joint action plan to increase social activity and social responsibility of students, and

further master new technologies, means of communication, programs and platforms for interaction in a remote online environment, actively applying them in practical social and educational activities;

- develop an action plan to increase volunteer activity among students, as well as to promote volunteer activities among students (50.7% did not volunteer, 19.8% of respondents were not interested).

5. Conclusion

The pandemic has opened up new opportunities for the library services in terms of working with remote users. Continuing to work online today, we are clearly aware of the unconditional limitations of the remote format of interaction with the audience. The lack of live communication and the individual characteristics of the information receivers make the transmission and perception of information less effective. Ayesha Vawda, the World Bank's lead education specialist in Central Asia, drew attention to the fact that the system and level of distance education during the pandemic still has some weaknesses and shortcomings. Few teachers were able to quickly learn how to use online content and prepare video lessons. Short-term sessions of 10-20 minutes are not always effective for fully understanding materials. At the same time, the learning process of most students was not assessed, and there was no full control from the authorities (Milenkaya, 2020).

The use of currently available educational content for distance learning has made it possible to:

- to organize various forms of students' activities for self-study (independent learning);
- apply the full range of possibilities of modern information and telecommunication technologies in the process of performing various types of educational activities;
- manage training, automate the processes of monitoring the results of educational activities, training and testing;
- create conditions for the implementation of self-study activities of students;
- to work in modern telecommunication environments, to ensure the management of information flows.

In conclusion, we would like to note that the classical full-time form of education will undergo changes in the future. There will be a merge of online and offline forms. Distance learning is possible only as a short-term replacement for the traditional education, or as an additional teaching method. In the context of distance learning, the relevance of using multimedia learning tools in the educational process is growing every year. And it is very important that after the end of the pandemic period there is no rejection of distance learning technologies, and the experience gained works to improve the quality of education.

References

Balykhin, M.G. E-learning and its role in education without borders. Bulletin of RUDN, 2008, no. 4, pp. 65-71.

Dabbagh, N., Kitsantas, A. (2012) Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. Internet and Higher Education, no. 15, pp. 3–8. Doi: http://dx.doi.org/10.1016/j.iheduc.2011.06.002.).

Garrison, R. (2000) Theoretical challenges for distance education in the 21st century: A shift from structural to transactional issues. The International Review of Research in Open and Distributed Learning, no. 1 (1), pp. 1-17.

Hargittai, E. (2002). Second-Level Digital Divide: Differences in People's Online Skills. First Monday. 7(4).

Jarmon, C. (1999) Fundamentals of Designing a Distance Learning Course: Strategies for Developing an Effective distance Learning Experience. In: M, Boas, B. Ellioff, D. Foshee, D. Howgy, C. Jarman, & D. Olcoff (Eds.), Teaching at a Distance: A Handbook for Instructors. pp. 1-14.

Keegan, D. (2002) The future of learning: from eLeaning to mLearning. ZIFF Papiere 119. Hagen: FernUniversität. R.198.

Kurmangulov, A. A., Frolova, O. I., Solov'eva, S. V. (2017) The Prospects of E-learning Implementation in Educational Process of Medical University. Higher Education in Russia, no. 8/9 (215), pp. 116–120. (In Russian).

Lomakina, O. V. Organization of social and educational work in higher school (the example of Kemerovo State University). Journal Bulletin of Kemerovo State University, 2014, No. 2 (58), pages 145-148.

Minina, V.N. Digitalization of higher education and its social results // Bulletin of St. Petersburg University. Sociology. 2020. Vol. 13. Issue 1. pp. 84-101. https://doi.org/10.21638/spbu12.2020.106).

New pedagogical and information technologies in the education system: textbook. manual for stud. higher. study. institutions / E.S. Polat, M.Yu. Bukharkina, M.V. Moiseeva, A.E. Petrov; ed. E. S. Polat. 3rd ed., Rev. and add. Moscow, Publishing Center "Academy", 2008. 272 p.

Nikulina, T.V., Starchenko E.B. (2018) Informatization and digitalization of education: concepts, technologies, management. Pedagogical education in Russia, no. 8, pp. 107-113.

Otto Peters on Distance Education. The Industrialization of Teaching and Learning, eBook Published 14 April 1994, https://doi.org/10.4324/9780203350249.

Pyari, D. (2011) Theory and Distance Education: At a Glance. 2011 5th International Conference on Distance Learning and Education IPCSIT, vol. 12. IACSIT Press, Singapore.

Sappey, J., Relf, S. (2010) Digital Technology Education and ItsImpact on Traditional Academic Roles and Practice. Journal of University Teaching and Learning Practice. 7(1): 3.

Smirnova, V.A. (2015) Features of the formation of modern information and educational environments. Yaroslavl Pedagogical Bulletin, no. 6, pp. 38-43.

Backchannels: 'Covert Digital Backchannels in the Overt Classroom'

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Abstract: A study of backchannel *communication* during lessons in higher education. This paper presents a study of how students utilise social media as backchannels for 'reflection in action', 'reflections on action', social banter and critique of the ongoing physical presence lesson with digital technologies. The research question was sparked by the overt ways in which the students communicated in the chat in videoconferences in online lessons during the first lock-down (March-June 2020). The students appeared to help each other and sort out practical and academic issues without involving the lecturer in the chat. This initial discovery led to an actual investigation of how the students communicate, digitally during physical presence lessons after the lock-down lifted. It became evident that most students engage in covert, digital communication during lessons. So, while the backchannel was overt and inclusive in online lessons, it turned into a covert exclusive practice in the physical, presence lessons. The paper introduces the notion of a 'backchannel' that carries undisclosed strands of student-initiated communication during a lesson. The study also identifies different types of backchannel communication that take place amongst students during lessons. Furthermore, the paper suggests a typological organisation of the different types of reflection the backchannels support. A backchannel is defined as a secondary, informal, unmanaged communication channel that happens simultaneously with a physical, presence lesson. The backchannel seems to be a process that either, covertly, support the students or, overtly, supports the lecturer and the students. The identified backchannels are divided into three different kinds of backchannels in the paper. The types found in the study include: 'Rhizomatic, covert backchannels', 'Lecturer initiated backchannels' and 'hybrid joint contribution backchannels'. The paper investigates the pedagogical circumstances under which the backchannels emerge and how they are utilized. Furthermore, the article discusses the implications that covered, digital meta-communication during the lessons that may have on the relationship between lecturer and students. Lastly, the paper presents suggestions for how to use the covert backchannels as a constructive element in the lessons. Finally, the article suggests pedagogical practices that offer the students other possibilities to engage and express insecurities and general questions during lessons and presentations.

Keywords: backchannels, social media, lecturer-centred teaching, student-initiated activities, reflection-in-action

1. Introduction

Most of us properly remember tossing 'paper-ball notes' to our classmates during class to let our peers know that the teacher's fly was open or to arrange after-school activities. The notes solidified relations between peers and excluded the other classmates – and the teacher. The communicative need that the notes represent may represent a 'real need' as opposed to a need contemplated by the teacher (Ayers, 2011; Parker, Maor, & Herrington, 2013). Furthermore, it may have developed a practice for the virtual part of a face-to-face lesson (F2F). It may appear in an ever-changing variety of common social media platforms that have often been problematised because they could turn into bullying in anonymous platforms like Ask.fm or Annomo. However, bullying could also happen on user disclosed platforms like TikTok, Instagram, Snapchat, etc (Ho, Chen, & Ng, 2017; Johansen & Larsen, 2020; Larsen, 2007; Larsen, 2019; Mischel & Kitsantas, 2019; Tække & Paulsen, 2016a; Tække & Paulsen, 2016b; Wilkinson, 2014).

The idea of having a parallel, digital communication channel during the lesson didn't only start out as a student invention, it also emerged as a teacher/instructor driven activity. The notion that participants (pupils, students, audiences, etc.) may benefit from having the means to contribute to the lesson, during the lesson, has presented itself in various forms during the last 15 years in media like; Twitter, TodaysMeet, PadLet, Socrative, etc. (Dr. Rankin, 2009; Kjærgaard, Thomas & Sorensen, 2014a; Manca, Lafferty, Fioratou, Smithies, & Hothersall, 2014; Mathiasen, 2011; Thoms, 2012).

However, the first attempts at engaging and interacting with an audience through technology started as early as the 1960ies, when TV producers wanted to test the audience's reactions to 'pilots' for TV series, etc. (Blackburn & Stroud, 2015; Maloy, Greene, & Malinowski, 2016). The technology was called Audience Response Systems (ARS by Audience Systems Hollywood 1966). Since then, the technologies for interaction have developed dramatically. The initial interactions were quantitative (yes/no, multiple choice) input, thus, making it a simple interaction providing rudimentary information to the producers of the TV series about the audience's

reception of the TV series. However, with the development of Web 2.0 tools some 40 years later (2008) the possible inputs became richer and included qualitative, multimodal inputs as we know them today.
In any case, the aims of utilising audience or student response systems (SRS) in class are similar, the interaction should motivate the students to participate and improve the lesson (or TV series). The inputs from the SRS inform the lecturer about the immediate reception of the lesson, thus, allowing the lecturer to adjust the pedagogical design on the fly. Thus, SRS becomes a potential tool for 'reflection in action' (Schön, 2017). Furthermore, the lecturer may include SRS to poll the students' understanding of the content of the lesson or to poll the opinions and attitudes towards the content of the lesson

Conversely, the recent focus on the importance of data protection (GDPR) has rooted out most of the open platforms for creating lecturer-initiated backchannels, which, in turn, leaves the lecturer with the GDPR-approved platforms that the institutions provide, which in this case narrows down the choice to Office365 tools and TEAMS as a Learning Management System (LMS), leaving it to the lecturer to analyse and utilise the, maybe, less obvious affordances of the approved technologies. However, the discovery in this article shows another kind of backchannel. A backchannel that is beyond the control of the lecturer and beyond the GDPR guidelines. This leads to the research question:

How do the students utilise self-initiated backchannels during lessons and what do they gain from participating in the backchannel communication?

1.1 Context of discovery

The findings in this article emerged in 2018 in a study of the implementation of blended learning at 4 University College programmes published in the article 'Hybrid Homework–Blending blended learning and face to face in four undergraduate education programmes' (Kjærgaard 2019). The study investigated the process of converting parts of a programme from presence lessons (F2F) to blended learning (BL). The study unveiled the students' dependency on PowerPoint presentations in F2F lessons and a strong dependency on affirmative, personal, and F2F feedback from the lecturer on the students' work. During the interviews for the initial study in 2018, it became clear that implementation of BL the learning designs would require a firm and structured rigour and that the students would need to be instructed on which learning strategies to develop and deploy to succeed in the BL learning designs (Kjærgaard, 2019). It also became evident that the BL learning designs needed a more structured and developed communication strategy from the lecturer. A strategy that included a shared backchannel, in which, the students could raise questions and present their work while the lesson was in session. However, the study also revealed an existing practice amongst students of utilising Facebook Messenger (FM) as an ad-hoc backchannel during lessons.

2. Empiric data

This section describes the data production and the empirical background for the findings. The first data production consisted of 4 online surveys distributed to students and interviews with lecturers, as described in (Kjærgaard 2019). The second data production session consisted of structured research interviews carried out on campus (Flick et al., 2007). The third data production session consisted of field notes from observations of the students' digital practices in lessons and in recorded online lessons. Investigating the students' covert communication practices turned out to be a sensitive matter because the students' unveiled communication that they regarded as confidential and personal, thus, the interviews and the filed notes are kept anonymous. The students only opened their FM threads to me because they themselves were interested in discussing the nature of the covert communication in the lessons. Their own interest was nurtured by the fact that they Themselves would be leaders of a classroom in a very near future, hence, they also wanted to know the results of this investigation.

Table 1: Data description

Data production	2017-2018	2019	2020	2021
Context of data	Data for (Kjærgaard 2019)	Data for this study		
Surveys	4 surveys to students and lecturers in the affected programme			Survey (2021) (Class L20-10, 2018) 19 students, Ba. of Edu.

Data production	2017-2018	2019	2020	2021
Interviews	19 students and 8 lecturers			Interview (2021) (Class L20-10, 2018) 3 students, Ba. of Edu.
Observations Fieldnotes	8 lessons in 4 programmes	Fieldnotes (2019) Insights to 4 students (Class L18-10, 2018) practices in FM during lessons. 21 students, Ba. of Edu.	Fieldnotes and observations (2020) Online (lockdown) (Class L18-10, 2018). 21 students, Ba. of Edu.	

3. Analysis of empiric data

The data were categorised according to, which type of communication the backchannel represented and according to the selection of participants in the backchannel. The categories for communication types that emerged were:

- Academic clarification (content),
- Discussion of lesson quality (form),
- Personal chat (non-academic).

The categories for backchannel participant selection were:

- democratic in online lessons (overt for everybody)
- undemocratic during F2F lessons (invited participants only)

3.1 Developing learning strategies – excrescences and outliers

In the unfilled vacuum of lacking lecturer guidance or requirements on how to develop a constructive backchannel practice on the one hand and a growing need for constructive practices for utilising relevant digital technologies, on the other hand, this study discovered new, rhizomatic excrescences filling the vacuum. The spontaneous, ad-hoc network is referred to as 'rhizomatic'. The metaphor is based on the biological term for a type of root network that allows weeds and other resilient plants to survive under harsh conditions. This metaphor is chosen for two reasons.

The first reason is that, according to the students, the backchannel emerges under conditions in which the network is not anticipated or desired by the lecturer, much like weeds appear in the garden in the places that are deemed mostly unwanted by the gardener. These rhizomatic excrescences emerged from an academic, yet informal, need to communicate and share amongst the students that the lecturers did not anticipate or address in the lessons.

The second reason is the metaphor's philosophical application. The sub-networks took on a rhizomatic character, which in philosophical terms refers to a sub-network that is unmanaged, non-hierarchical, unstructured, and empowering the students to become agents in the backchannel (Buchanan, 2007; Deleuze & Guattari, 1987; Kjærgaard, Thomas & Sorensen, 2014a; Kjærgaard, Thomas & Sorensen, 2014b; Kjærgaard, Thomas & Sorensen, 2014c; Kjærgaard, Thomas, 2016). The philosophical 'rhizome' describes exchanges that enable the vitalization of self-efficacy in plateaus of intensity.

3.2 Facebook Messenger (FM) as a rhizomatic channel for communication

The backchannel could be understood as a digital brethren to the archaic 'paper ball notes' containing a 'secret' message from one student to another that flew across the classroom in the 'analogue' classroom of the last century.

According to the survey (2021) and fieldnotes (2019), the students start a backchannel in FM due to an unexpected occurrence during the lesson. Examples from the interviews:

- A student explains that a specific backchannel emerged when the lecturer started singling out specific students, requesting them to answer academic questions. The message read 'What just happened?' and:

'Does anybody know the answer, let's help xxx'. The student later reflected that the teacher, assumably, reacted to a quiet and nonparticipating class and that the teacher acted out of desperation.

- In other observations, the students would create ad-hoc groups with peers to find the answer and post it in the backchannel. The students utilised FM to form sub-networks for communication during the lessons.
- Sharing notes and explaining tasks
- Clarifying and understanding the content of the lecturer's presentation

The messenger groups emerged when the lesson took an unanticipated direction or when the students got bored. A reoccurring reason for using the backchannels is sharing notes. In the survey, interviews and field notes from observations, the students express the following scenarios as triggers for enabling the backchannel and starting a FM conversation with peers:

- When the lecturer spontaneously asked random students questions during the lesson
- When the lecturer asked a question that was regarded as out of scope for what the students had prepared for the lessons
- If the lecturers presented themes, theories, topics, and content that left a group of students not able to follow the presentation during a lesson
- The membership of the messenger groups was determined by who amongst the students in the room considered themselves as peers.
- The lecturer was never part of the FM group.
- The students also express that the emergence and utilisation of the backchannel is depending on the relation to the lecturer. If they are confident and feel comfortable with the lecturer, the students would rather ask the lecturer upfront than engage in backchannel communication
- The backchannels also emerged as a pastime during lecturing, where the students shared humours memes, online shopping advise and general banter.

3.3 Democratic pitfall

The affordance of FM, as it is designed now (august 2020), lends itself to forming ad-hoc groups because you can gather groups merely by typing in the names of the people you want in the group. The accumulated number of FM users/friends constitutes the total population of the group, thus setting the outer perimeter of the network to only include FM users, which challenges the democratic aspect of the network. The students who do not have a Facebook account are unable to take part and participate in the sub-network. This is an exclusion mechanism that we normally strive to avoid. In the pedagogical attempt to design and practice an inclusive classroom, we normally make equal participation a crucial circumstance for assessing the quality of our learning designs and teaching practices. Furthermore, the lecturer is excluded from the community on FM. Formally, due to the GDPR and university policies and, informally, due to the individual practice and belief of the lecturer regarding the privacy issues that may emerge from participating in Facebook networks with students. FM offers many relevant and effective means of communication between students and lecturers, conversely, it also blurs the ecotones between an educational area and a personal arena (Dau, 2016; Kjærgaard, Thomas & Sorensen, 2014a). Hence, FM is a contested technology in education because it includes immediate and relevant affordances for communication, however, it also raises a series of ethical questions on the relation between lecturers and students and data protection issues.

3.4 Democracy amongst peers – from 'reflection in action' to 'reflection on action'

The students' positive reasons for creating the messenger groups are to support each other in understanding the content of the lessons as a means to 'reflect in action' and not directly to discuss the quality of the lesson as a means to 'reflect on action' (Schön, 2017). The students express a need to deliberate the meaning of the content of the lessons in a safe environment before venturing into answering or raising questions in class. However, most lecturers in the study would prefer the classroom to be a safe environment in which all students feel safe to ask questions and engage in open, overt dialogue. The mere suggestion that the students should need a covert sub-network to deliberate what the lesson is about a regarded as problematic. Furthermore, the alleged need for a covert backchannel to deliberate who amongst the students are the appropriate ones to raise

a question is slightly provocative and unnerving. It is, in some respect, interpreted as a slight rebellion against the lecturer's supremacy in the classroom by the lecturers.

Another thing to factor in is that the lessons were conducted in English, while the backchannel communication was in Danish. This code-switching element of thinking in Danish and expressing oneself in English is very difficult for many students. The backchannel allowed the students to deliberate and answer in Danish and postpone the translation to English to the last minute before answering the question. In another example from the fieldnotes, the students would write in layman's terms in the backchannel before deciding on the more precise academic terms.

Organising in smaller communities within the class

Another element to consider is the class size in the context in question (n: 28 students). The number of students in the context of an English lesson appears to be inversely proportional to the willingness and confidence to participate in the dialogue (Dweck, 1975; Dweck & Wortman, 1982; Kjærgaard, T. & Lukassen, 2020). The fewer students, the more participation in the dialogue seems to be the rationale. According to the studies on how class-size and learning outcome interrelate, the optimal number of students in a dialogic learning context is between 7-15 students (Glass & Smith, 1979; Hattie, 2005; Monks & Schmidt, 2010; Schanzenbach, 2014). The backchannels seem to consist of approximately 5-8 students according to the students in this study, which supports the notion that smaller communities of self-chosen peers instil confidence in the students. Group work in smaller communities is a very common way for lecturers to organise the academic work in the lesson at this institution, however, it is mostly decided by the lecturer when, how and with whom the group work should be carried out.

4. Backchannels in online learning- 'hybrid, joint collaboration backchannel

This section describes and analyses backchannels identified in the same demographic group (21 teacher students, observations (2020)) in the online learning contexts that emerged during the lockdown (12/3-30/6 2020). The section focuses on online, synchronous lessons in English for teacher students. In the online context, the covert and overt networks become a hotchpot of synchronous communication in a complex network of teacher engaged and managed activities and overt, student-engaged sub-networks. The complex and mixed appearance of the communication during the online lessons is elaborated with an example from an online lesson on language acquisition at a University College in Denmark.

Context description: A student is attempting to express her experiences with 'school refusal' and the 'affective filtering' in language acquisition theory. She gives an example and code-switches to Danish for her to enable a broader vocabulary to express the complex nature of 'school refusal'. This is the same group of students that relied on covert backchannels in F2F teaching. In the online lesson, the students are confident enough to deliberate their answers in the open backchannel. This finding leads to the notion that the students might benefit from always having an overt, teacher-initiated backchannel. The data doesn't provide insights into why the students are more confident to engage in an overt backchannel in online teaching than they appear to be in a F2F lesson. However, the fact that the backchannel conversation is in layman's terms in Danish may be an educated guess why the students are more prone to participate. In the research on the use of backchannels in teaching, the lecturer seems to set up the requirements for participating in the backchannel in academic terms and the target language or the lecturer chooses a platform for a specific affordance (Carpenter, 2015; Du, Rosson, & Carroll, 2012; Harunasari & Halim, 2019). In the case of choosing a specific affordance in a specific platform (Ig. hashtags on Twitter), the communication is conditioned by the affordance of the platform and not by the immediate need for communication. In the example below the backchannel is un-managed and it only serves the needs of the students, thus evoking the confidence to utilise the backchannel. In the screenshot below, taken during an online lesson, communication is mixed between private/humorous exchanges and academic deliberation. It is written in Danish leading to an oral answer in the videoconference in English:

The overt backchannel (chat in webinar-tool) of the online lesson serves as an open network for all to participate in, thus, making it an appropriate space for the lecturer, to elaborate and clarify the content of the lesson, thus, making it a 'hybrid, joint collaboration backchannel'. The number of students taking part in the backchannel and the polls was 23 out of 25 students and the interesting aspect of the example was that in the run of 56 online lessons during the spring of 2020, the students didn't utilise the covert messenger subgroups for academic

purposes. This should be seen in relation to a near 100% occurrence of covert sub-networks in F2F lessons. Unfortunately, we can only guess why that is, maybe the physical distance serves as a disarming mechanism? Maybe the lessons are more univocal and focused when designed as webinars? Maybe the students are more attentive? And, lastly, maybe the students also run a FM chat alongside the 'official' chat?

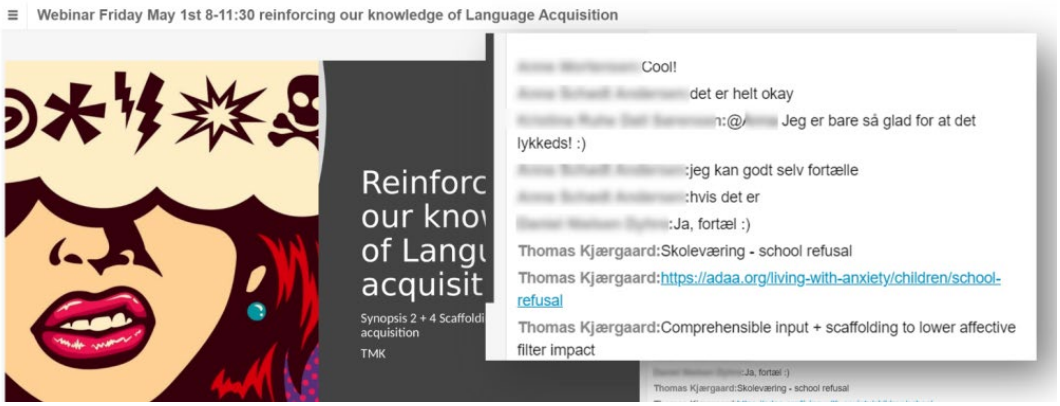

Figure 1: Overt webinar chat

In the next example, the webinar contains a game of Jeopardy. The quizzes were designed by the students for the students and deployed in the webinar tool. In this case, the chat served as my means to help the students. In the example below I choose to disclose the theoretical term to make sure the peer structure did not lower the academic level of the quiz. Had the backchannel been covered, I would not have had that opportunity.

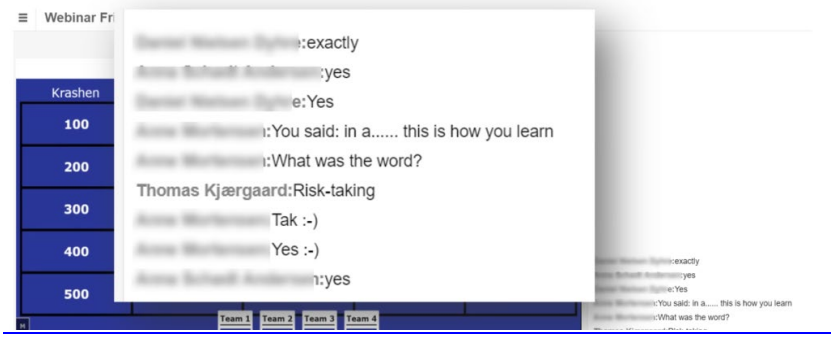

Figure 2: Overt webinar chat

The chat also included simultaneous, social commentary among the academic inputs in the chat, which introduced another challenge, namely, the challenge of separating social from academic content. In this case, I copy/pasted the academic content into our shared class notes, thus making it possible for the students to use the academic back-channel content at a later point in time.

5. Concluding comments

It surprised us that the need for covered, rhizomatic back-channels are more prone to emerge in a F2F lesson than in an online webinar. Our data do not give reasons why, thus we continue the research into the matter of overt vs covered dialogue and democratic backchannels vs closed, peers-only backchannels in both F2F and webinars. The conflict between a lecturer-initiated backchannel with an academic purpose and the student-initiated backchannel for 'reflection in action' pinpoints why this a difficult issue to handle. Promoting 'reflection in action' and the possibility to participate with the abilities that the individual student possesses is an important and inclusive pedagogical practice. However, it appears very difficult to design a 'hybrid joint-collaboration' backchannel without either making the backchannel an academic, lecturer conjured up idea with very little activity or a rhizomatic, student-driven, immediate solution to a 'real need' for reflection amongst peers. The in-between state where the backchannel is both beneficial for the lecturer and the students emerged in the online lessons described in this article. It emerged because the lecturer acted inclusive (accepting Danish communication) and academic (responding to academic questions). Furthermore, the backchannel wasn't the focus of attention it was only a supplement to the oral exchanges. We suggest the development of local 'hybrid, joint collaboration backchannel practices that synthesise academic agendas with the students' 'reel need'.

References

Blackburn, M., & Stroud, J. (2015). Voices from 'the other side'—using personal response systems to support student engagement. *Smart Learning,* , 199.

Buchanan, I. (2007). Deleuze and the internet. Carpenter, J. P. (2015). Digital backchannels: Giving every student a voice. *Educational Leadership, 72*(8), 54-58.

Dau, S. (2016). (2016). The borderland: How blurred ecotones influence study activities. Paper presented at the *EDUlearn16: 8th International Conference on Education and New Learning Technologies*

Deleuze, G., & Guattari, F. (1987). 1000 plateaus, capitalism and schizophrenia.

Dr. Rankin. (2009). The twitter experiment – twitter in the classroom dr. rankin, professor of history at UT dallas. Retrieved from https://www.youtube.com/watch?v=6WPVWDkF7U8

Du, H., Rosson, M. B., & Carroll, J. M. (2012). (2012). Augmenting classroom participation through public digital backchannels. Paper presented at the *Proceedings of the 17th ACM International Conference on Supporting Group Work,* 155-164.

Dweck, C. S. (1975). The role of expectations and attributions in the alleviation of learned helplessness. *Journal of Personality and Social Psychology, 31*(4), 674.

Dweck, C. S., & Wortman, C. B. (1982). Learned helplessness, anxiety, and achievement motivation: Neglected parallels in cognitive, affective, and coping responses. *Series in Clinical & Community Psychology: Achievement, Stress, & Anxiety*

Flick, U., Kvale, S., Angrosino, M. V., Barbour, R. S., Banks, M., Gibbs, G., & Rapley, T. (2007). Doing interviews

Glass, G. V., & Smith, M. L. (1979). Meta-analysis of research on class size and achievement. *Educational Evaluation and Policy Analysis, 1*(1), 2-16.

Harunasari, S. Y., & Halim, N. (2019). Digital backchannel: Promoting students' engagement in EFL large class. *International Journal of Emerging Technologies in Learning, 14*(7)

Hattie, J. (2005). The paradox of reducing class size and improving learning outcomes. *International Journal of Educational Research, 43*(6), 387-425.

Ho, S. S., Chen, L., & Ng, A. P. Y. (2017). Comparing cyberbullying perpetration on social media between primary and secondary school students. *Computers & Education, 109*, 74-84. doi:10.1016/j.compedu.2017.02.004

Johansen, S. L., & Larsen, M. C. (2020). *Undersøgelser af børn, unge og medier* Samfundslitteratur.

Kjærgaard, T., & Lukassen, N. (2020). Læringsstrategier og strategisk undervisning. *CEPRA-Striben,* (26), 54-65.

Kjærgaard, T. (2016). *The full circle of PowerPoint: Investigating the use of digital technology in university college teaching: And deleuze inspired suggestions for development*

Kjærgaard, T. (2019). (2019). Hybrid Homework–Blending blended learning and face to face in four undergraduate education programmes. Paper presented at the *World Conference on Online Learning,*

Kjærgaard, T., & Sorensen, E. K. Open source learning streams in online discussions in e-learning. Paper presented at the *Ecel 2014,* ECEL Copenhagen.

Kjærgaard, T., & Sorensen, E. K. Qualifying the quantified self – A study of conscious learning. Paper presented at the *Icel 2014,* ICEL Chile.

Kjærgaard, T., & Sorensen, E. K. Rhizomatic, digital habitat – A study of connected learning and technology application. Paper presented at the *Icel 2014, , ICEL 2014*(1)

Larsen, M. C. (2007). Understanding social networking: On young people's construction and co-construction of identity online. *Internet Research, 8*

Larsen, M. C. (2019). Sociale medier og trivsel i ungdomslivet: Hvordan kan sundhedsplejersker gå i dialog med børn og unge om deres online hverdagsliv? *Sundhedsplejersken,*

Maloy, R. W., Greene, J., & Malinowski, A. (2016). Wikiquests, microblogging, and personal response systems in the history classroom. Teaching History: A Journal of Methods, 41(2), 84-98.

Manca, A., Lafferty, N., Fioratou, E., Smithies, A., & Hothersall, E.Integrating twitter into an undergraduate medical curriculum: Lessons for the future. Paper presented at the *European Conference on E-Learning,* 330.

Mathiasen, H. (2011). Clickers, en læringsunderstøttende ressource? *Dansk Universitetspædagogisk Tidsskrift, 6*(11), 26-31.

Mischel, J., & Kitsantas, A. (2019). Middle school students' perceptions of school climate, bullying prevalence, and social support and coping. *Social Psychology of Education,* doi:10.1007/s11218-019-09522-5

Monks, J., & Schmidt, R. (2010). The impact of class size and number of students on outcomes in higher education.

Norman, D. A. (1999). Affordance, conventions, and design. *Interactions, 6*(3), 38-43.

Schanzenbach, D. W. (2014). Does class size matter. *Policy Briefs, National Education Policy Center, School of Education, University of Colorado, Boulder,*

Schön, D. A. (2017). *The reflective practitioner: How professionals think in action* Routledge.

Tække, J., & Paulsen, M. (2016a). Sociale medier og ulovlige netværk i gymnasieskolen. *MedieKultur: Journal of Media and Communication Research, 31*(59), 22.

Tække, J., & Paulsen, M. (2016b). *Undervisningsfællesskaber og læringsnetværk i den digitale tidsalder* (1st ed.). Kbh: Unge Pædagoger.

Thoms, B. (2012). Student perceptions of microblogging: Integrating twitter with blogging to support learning and interaction. *Journal of Information Technology Education: Innovations in Practice, 11*(1), 179-197.

Wilkinson, J. (2014). The cyber bullying epidemic. *Prep School,* (79), 30-33.

Is the Synchronous Tutorial Still a Learning Activity in the 21st Century?

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Abstract: "Is the Synchronous Tutorial still a central learning activity in the 21st Century?" The Tutorial or seminar is a key aspect of many academic courses and provides opportunities for the student to ask questions and investigate ideas and theories on the theme of the module being studied. Prior to the COVID-19 Pandemic Universities were investing in Digital technologies to support student learning. This has involved using products such as managed learning environments to store learning materials and to record synchronous sessions. Evaluation of learning during the COVID-19 Pandemic is raising a number of questions regarding providing direction to students on a module. While some institutions have invested in technology to record in class sessions the move to online teaching during the COVID-19 pandemic made recording of synchronous sessions much easier. Scheduled classes are seen as key to establishing study patterns for students and provide focus at set points during the study week. The trend to record everything that is delivered to students may end up changing student study patterns with an implicit movement to asynchronous leaving activities. Why attend when a recording can be viewed? Alternatively, is recording just a natural progression that is supported by modern Educational Technology? This paper will explore the effects the record everything culture is having on learning in Higher Education and will seek to investigate if there is still a role for the synchronous Tutorial in the 21st Century.

Keywords: tutorial, recording, active learner, online tutorial, oxford tutorial

1. Introduction

The traditional Oxford Tutorial model of small groups of students meeting on a regular basis to discuss the content of material covered in lectures is a very well-established model stretching back to the 11th Century (Beck, 2007), (Palfreyman, 2001). In the 21st Century technology has played a significant part in higher education supporting both face to face learning and distance learning (Lambie, 2018), (Syynimaa, 2019), (Nordmann, *et al.* ,2019), (Le, 2022), (Bond et al, 2020). However different learning approaches utilise tutorials and supporting lectures in different ways and while it is possible to move classes online thought needs to be given to how this is done. Lambie and Law (2015,2016,2017,2018,2020) have examined the difficulties of moving Tutorials online and in particular highlighted the lack of visual and aural cues in online Tutorials compared with face to face Tutorials. This can make it difficult for the Pedagogue to assess what is happening in the session. This lack of audio and visual cues can impact on the running of the traditional Oxford Tutorial in terms of student/student and student/pedagogue interaction**.**

The authors experience spans two distinct Higher Education sectors. The first is the traditional University set up with students expected to attend face to face sessions over a 12 week semester and the second is straight distance learning where students receive study material by post with further online material via an online course planner. In the distance learning world, the study period is extended to take into account that students mostly work and are therefore studying part time. Some face to face Tutorials are organized with further online sessions to support students studying at a distance. The authors are interested in whether there is value to students in the recording of an online Tutorial and how students access the recording.

In the authors experience the Tutorial session is a key component of student learning and provides opportunities to deepen the knowledge they are gaining via lectures (either face to face or online) and other sessions such as practical work in laboratories. The discursive nature of the Tutorial provides opportunity to discuss and enrich the knowledge of the student. The opportunity for the student to assume a "teaching" role as part of this activity is a central idea of the Oxford Tutorial style and illustrates the idea of student and pedagogue appearing to be equals in this setting in which both have contributions to make (Beck, 2007), (Palfreyman, 2001). Technology has opened up the manner in which Tutorials can be delivered and accessed by students. Online Tutorial sessions can be easily recorded with the opportunity for students to review work that was covered in an online Tutorial session. It is interesting to note that in the authors experience in the online world there always seems to be a small core of active learning students who regularly attend online Tutorials. Looking ahead to Table 1 it would also appear that some of these students access the recordings of the live sessions in order to further reflect on

the concepts that have been covered. So, it would appear that for some students there is value in the Tutorial recordings.

In the authors face to face role the move online caused by the COVID19 lockdown has driven the demand for recordings of online lectures. This demand for online recordings has further expanded and now includes practical sessions which utilised a demonstration aspect via the screen sharing option in the Managed Learning Environment (MLE) (Module Evaluation Survey, 2022). The module evaluation survey was for a Mobile Computer Programming module. To date there has not been any significant demand for the recording of Tutorial sessions from students attending the day University. The assessment for the practical programming module identified, did have a class test component, so Tutorials were the natural place to cover related material and appropriate questions. The authors are therefore questioning what is the purpose of recording Tutorial sessions in order to support student learning as part of the overall clamour to record primarily online activities. There is scope to compare this with their distance learning experience where there is an expectation that online Tutorials are recorded.

The authors note that the recording of live lectures was already a well established practice in some institutions (Nordman, 2019), (Llamas-Nistal and Mikic-Fonte, 2014). In the pre-COVID years the authors' employing institution had not invested in lecture capture facilities in the face to face setting, so the ability to review a recorded lecture was new to students as a result of online working. Similarly, the recording of practical demonstrations in labs was not possible in the Pre-Covid live Face to face situation, but online practical demonstration using an MLE were possible. So again, are recordings of positive value to students?

If the experience of living through the COVID-19 pandemic has forced us to think about one thing and one thing only then it is the sense of community that was lost due to the enforced lockdown in many countries. Higher education suffered from this loss of community in the same way as many other parts of society. However, to compensate Universities had already invested in a range of Managed Learning Environments (MLE) such as Blackboard, WebCT etc. over a period of several years and were able to effectively use this technology to lessen the shock of going fully online. Tutorials are one "formal" place where students can come together to discuss the ideas being covered in a particular area and hence form a learning community. The Tutorial or seminar session was one area where a learning community needed to be created directly in the online world to facilitate discussion about a specific topic and to overcome the restrictions placed on learning by strict lockdowns. Lambie and Law (2015,2016,2017,2018,2020) identified that moving online is not a simple task and can suffer from a lack of visual and aural cues with the Tutor having to rethink the way that a session is delivered. This requires a rethinking of the way questions are posed and answers solicited and in how the online session is conducted (one large group or with a number of small breakout groups in separate virtual rooms). In this context of community what role do Tutorial recordings play?

Gwebu et al. (2021) suggest that an effective learning community has several functions including; assisting students to initiate both academic and social support networks, providing an environment that allows the student to acclimatize to the expectations of university and an environment providing community delivered academic aid. Gwebu et al. (2021) cite several key aspects from Tinto (2010) research into the conditions that support student retention, highlighting the need to articulate the "expectations" of, in this case, participation in an online tutorial as a driver for the student to maximise the benefit of attending and participating in the online tutorial. It is therefore fundamental that those attending an online tutorial should be told what is expected of them regarding participation effort, behaviour, and interaction during the online tutorial thus providing them with the ground rules for success. Having set the ground rules for participation effort, behaviour, and interaction the student should have a successful online tutorial session and being buoyed by this, return for future online tutorial sessions.

Tinto (2010) cites "feedback" and "involvement" as the backbone of the student's ability to maximise their benefit from participating in all aspects of university life and in turn being part of a learning community (cited in Gwebu et al., 2021, p. 4). Feedback plays a vital role in helping the student acknowledge the consequences of their behaviour on aiding or diminishing their ability to be successful. Also noted, is the value of peer feedback and its role in helping the student successfully adapt their social skills to better assimilate themselves into the university environment. The suggestion is that the "social feedback" can be procured from "involvement" hence the more that the student participates both academically and socially the more likely it is that they will endure throughout their studies due to their sense of community.

Assessment goes hand in hand with any academic course with the nature of the assessment influenced by the subject area and the nature of the topic being investigated. A typical assessment arrangement is an exam and a coursework with various weightings possible for the split of assessment components. In practical modules such as found on computing courses the practical lab sessions feed into the coursework component of the assessment. Where an exam or class test component is included, it is likely that Tutorials will feed into this assessment component. In order to progress the discussion, it is worth investigating the role of a Tutorial session in the Higher Education Context in order to determine if there are any merits in recording the session. To do this the authors will draw on their experience of working in the face to face and online world.

2. Literature review

The literature review seeks to examine the role of a Tutorial and discuss if recording the tutorial could enhance the student experience.

2.1 The role of the tutorial

Beck (2007) identifies that tutorials are intended to help students to think for themselves. This will require the student to have prepared some form of answer to questions set by a Tutor or from having engaged with the material covered in a lecture or as a result of some form of flipped classroom scenario. In the face to face Tutorial there are variations on how the traditional Oxford Tutorial can be delivered as discussed by Balwant and Doon (2021). This is of particular interest where resources are much tighter and the one Tutor to two or three student Tutorial ratio is not possible.

In all of this, student engagement is still the key with the need for the student to have done the work.

What advantage then does recording a Tutorial session provide in the Higher Educational Environment? It would provide a verbatim record of what was discussed and may allow a student to return to the recording in order to review the discussions. This may be useful in preparing work for a piece of assessment. The assumption is that recording facilities are readily available in the face to face world and that the participants agree to the recording of the session. In the online world recording the Tutorial session is much easier and is generally provided as a facility by the synchronous delivery tool (Blackboard Collaborate, Adobe Connect etc.). However, moving completely or partially online raises questions regarding student engagement. Hudson and Luska (2013) indicate that recording Tutorial sessions results in a reduced attendance at live sessions. To counteract this, they propose including live demonstrations as part of the live session, even then attendance rates at live sessions of around 53% seem to be acceptable.

According to Beck (2007), the essence of the “Oxford Tutorial” from which the modern tutorial is derived centres around three key aspects. Firstly, one to two students per tutor; secondly, essay reading and thirdly, critical questioning and discussion. For most Universities, the first key aspect, the ratio of students to tutor is not achievable as it is not economically viable (Beck, 2007). Interestingly, Beck (2007), further cites several reasons from the student’s perspective for the change in tutorial format including students have varying ideas of what a tutorial is; due to variances in cognitive expectations, students' preferences for pedagogical methods are evolving and an increasing preference for group learning. Becker (2007) postulates that there is no formal pedagogical theory to explain the tutorial or any justifications for why it has persisted for so long and therefore why it is regarded as so successful; to this end prompting a study to produce an ethnographic characterisation of the tutorial as a setting for teaching and learning.

The objectives of tutorial education, according to Clark (1955), includes instilling in students a confidence in their own judgments and conclusions, developing independent thinkers, and develop students’ abilities to convey themselves via writing or other presentational means (cited in Becker, 2007, p. 5). First of all, how does moving online affect this activity and secondly how then would a recording of a tutorial session be of use in developing critical and independent thought? Bowler and Raiker (2011) suggest, based on their review of the available literature, there is a dearth of pedagogical recommendations for delivering effectual tutorials through online synchronous discussion. In their paper, they discuss the procedure used to develop a pedagogical framework that would help tutors lead successful online synchronous tutorials within a higher education setting. Factors to consider when undertaking an online synchronous tutorial discussion include the group size, the tutorial’s nature, the features of the application being used and, importantly, understanding that the tutor and the student both have roles within the tutorial (Bowler and Raiker, 2011). Bowler and Raiker (2011) further stipulate

that online synchronous discussion falls into two groups: online synchronous tutorials and online synchronous instruction.

As part of their research, Bowler and Raiker (2011), cited the work of Mason (1991) and Lim and Cheah (2003) whose work provides the central behaviours and incumbencies for the online tutor. This work centres around Mason's division of the online tutor's responsibility into three categories: managerial, intellectual and social and Bowler and Raiker (2011) propose that Lim and Cheah (2003) six roles dovetail with Mason's three underlying responsibility categories. Based on Mason and Lim and Cheah's work they produced a table to document the roles and responsibilities of the online tutor which is reproduced below.

Table 1: Roles and responsibilities of the online tutor. Bowler and Raiker (2011)

Mason's (1991) three responsibilities for the online tutor		
Social	Organisational	Intellectual
Effective open discussion requires a safe, supportive environment -welcome message; encourage participation; reward positive contributions	Ensure students can access discussions and manage dialogue -objectives; agenda; rules	Provide meaningful learning opportunities for students -Focus the discussion; ask questions; summarise; develop themes; design activities; critique
Lim & Cheah's (2003) six roles of the tutor in asynchronous discussion		
Keeping the discussion focused	Setting meaningful tasks Guiding participants in the 'technicality' of online discussion	Answering queries, providing feedback and posing conflicting views to elicit thinking/reflection Drawing conclusions and providing content expertise Recommending resources for extension of learning

As part of their research, Bowler and Raiker (2011) report on the work of Ligorio et al. (2002) who determine four categories of online tutor's responsibility: social, managerial, technical, and pedagogical. However, Bowler and Raiker (2011) oppose Ligorio et al. (2002) definition of pedagogy which makes it a separate category contending that pedagogy is ingrained all categories. Apart from guidance regarding using the online technology the points in Table 1 apply in the face to face world as well.

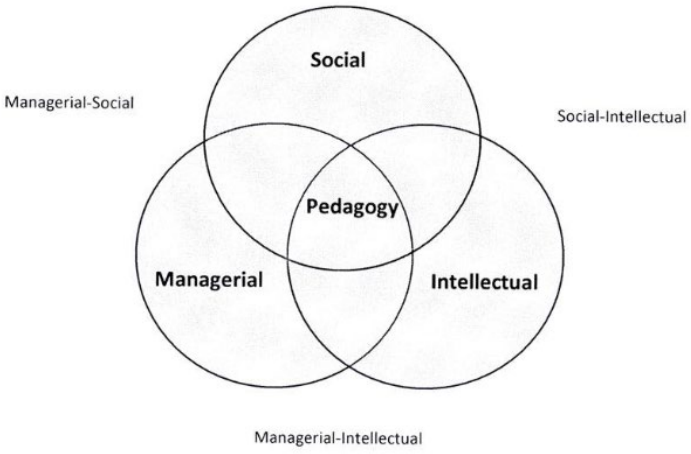

Figure 1: A pedagogical framework for facilitating online synchronous tutorial discussion. Bowler and Raiker (2011)

Bowler and Raiker (2011) expressed the belief that the models presented by Mason (1991) and Lim and Cheah (2003) offered a linear perspective that did not fully express the intricacies of applying a socio-constructivist approach, hence, within their proposed framework they suggest pedagogy is the essence of teaching and learning. Findings resulting from the Bowler and Raiker (2011) study suggest that tutorial group sizes should be restricted to an amount which will afford purposeful dialogue in the range 15 – 20 students; instruction should be provided for tutors on the influence of pedagogy on the social, managerial, and intellectual elements of the

student/tutor roles and responsibilities; finally, students should be made aware of the similarities and differences between social made applications and the online synchronous tutorial system being used.

The argument here may be that managing the face to face situation is much easier that a multi faceted online session. Adding the additional dimension of recording tutorial sessions further adds to the complexity of the situation. Hudson and Luska (2013a, 2013b), indicate that recording tutorial sessions results in a reduced attendance at live sessions. To counteract this, they propose including live demonstrations as part of the live session, even then attendance rates of around 53% seem to be acceptable.

It is clear that there is a dichotomy between the purity of the oxford style tutorial with the emphasise on presenting an appropriate argument and the need to help students focus on key points to get them through impending assessments.

2.2 The role of technology in delivering lectures

Access to resources is a key factor in the 21st century with an increasing emphasis on the use of Computing and Information Technology (C and IT) in the delivery of content. In fact, you could now argue that C and IT is core to the delivery of Higher Education. So, the question is what role do live sessions (Lectures. Labs. and tutorials) play in this process and what are the reasons for recording them?

Lectures are traditionally seen as being the source of providing knowledge or at least direction to provide direction in some way. This is usually focused on the identification of a specific theory or approach to the solving of a particular problem. Prior to COVID-19 some institutions had already invested in lecture recording equipment with the focus being on recording the Powerpoint slides and the associated commentary by the Lecturer. Students report that there are a number of good reasons for wanting lectures recorded (Mackay, 2019) These include:

- An opportunity to follow the lecture if the live session was missed
- An opportunity to go back over specific sections of the lecture in relation to material they found difficult

For the academic delivering the material there is the dilemma of how best to support the learning activities of individual students balanced against the overall workload. Should the recorded lecture session simply replace the live session in a flipped classroom approach? (Mackay, 2019). This would “free up” the live session for possible alternative uses but would not reduce workload on the Module Leader as time and effort needs to be put into producing the Lecture recordings.

2.3 The role of technology in delivering tutorials

In the wider context the question is what role does technology play in the 21st century higher education environment. Is the ability to record a Lecture and a tutorial session either face to face or online just a natural progression as recording technology becomes ubiquitous?

As part of their research, Bowler and Raiker (2011), cited the work of Mason (1991) and Lim and Cheah (2003) who’s work provides the central behaviours and incumbencies for the online tutor. This work centres around Mason’s division of the online tutor’s responsibility into three categories: managerial, intellectual and social Bowler and Raiker (2011) further propose that Lim and Cheah (2003) six roles dovetail with Mason’s three underlying responsibility categories. Based on Mason and Lim and Cheah’s work they produced a table to document the roles and responsibilities of the online tutor which is reproduced below.

In terms of online Lectures, the authors report that some students prefer a pre-recorded session which does not have any question and answer sections. This commentary came about from the module evaluation questionnaires that students fill in towards the end of a module delivery (Module Evaluation Survey, April 2022). Therefore, should the tutorial where “specimen” answers are discussed also be recorded and made available to students. In addition, there were requests to have practical demonstrations delivered during online lab sessions recorded. The rational given by students for this was that it provided an opportunity to review the demonstration again in order to try and understand the activity or if the session was missed the opportunity to view the missed session. There do, therefore, seem to be good reasons to record online sessions for specific topic areas such as Computer Programming. The ease with which the online session can be recorded along with

the ability to demonstrate practical activities makes this task a practical proposition which the student can use as a specific resource. So there seems to be some merit in reviewing the recorded session in terms of the discussion (answers) provided. There is also some negativity associated with this. Previously the loss of a learning community was commented on, and recordings may contribute to this as identified by Hudson and Luska (2013a, 2013b). There is the danger of funnelling students into their own private learning world.

For the academic delivering the material there is the dilemma of how best to support the learning activities of individual students balanced against the overall workload. Should the recoded lecture session simply replace the live session in a flipped classroom approach (Syynimaa,2019). Are the benefits of recording the tutorial the same? In conclusion the way forward may involve further education of students as to the purpose of recordings. There is a tendency to view recordings in a negative context of simply being an alternative to a live session particularly for students who missed the live event.

This suggestion then is that tutorial recordings are just a progression of the use of technology. The challenge for the pedagogue is how to use a tutorial recording in a positive way among the multitude of recordings available to students?

3. Investigation

There is the perception that prior to COVID engagement in higher education was excellent and everything in the garden was rosy! This is unlikely to be the case universally and that face to face engagement is in some ways hampered by the role that managed learning environments play in the delivery of content in higher education. With the increased use and dependency on Managed Learning Environments there has been a decrease in direct student participation in some subjects with an increased use of the MLE to compensate. It may be the case that technology is now available to support learning and for example, notes no longer need to be copied but can be downloaded electronically instead, with the opportunity to annotate as needed.

The investigation therefore seeks to focus on the role that recordings play in the learning that students engage in focusing specifically on tutorials. The literature has reported a mixture of positive and negative aspects of providing recordings.

The advantages include:

- **Positive aspects**
- Reviewing specific sections to review difficult content
- Producing focused content free from interruptions
- Content can be reviewed for revision purposes
- **Negative aspects**
- Recording is simply a replacement for missing a live session so there is potentially no need to attend
- Some aspects of social interaction may be lost by not attending. Questions can't be asked directly when they arise
- Is the focus too much on skills development rather than critical thinking?

Are recordings therefore just a natural progression in the use of technology and do the benefits outweigh the negatives? The question really is in what way does the use of a recording enhance a particular aspect of student learning and how do students engage with the recordings in a positive way. Perhaps the use of recordings needs to be built into a module? For example, including some content that is only in the recording? This would provide a positive incentive to engage with the activity of listening to the recordings. This is in contrast to Hudson and Luska(2013a) which took the approach of including activities in the live session that were not in the recording.

It is worth discussing/identifying what we mean by a recording. Possible approaches include:

- Narrative to accompany Powerpoint slides
- Talking head with the speaker visible during the playback because their talking was recorded using a camera during preparation
- Practical demonstration of a specific skill or worked example

In the case of an online tutorial the session is likely to be:

- Focused questions on a specific topic
- Small discussion groups in virtual breakout rooms

4. Analysis

At the time of writing, the authors had experience of delivering three specific modules in distance learning mode along with online tutorial sessions which were recorded. The recordings are available to students in their region along with the recordings produced by other Tutors. The module topics were Information Technology and Web Technology

A summary of the recordings and views can be found below. The Information Technology Courses are delivered twice a year and the Web Technology course is delivered once per year from October to June.

Table 2: Views per recorded tutorial

Information Technology course 1	No of recordings in cluster	Total Number of Views from students in the cluster	Mean number of Views per Recorded tutorial (Views/recordings)	Mean number of Views per Student (Views/Student)	Total Number of Students in the cluster	Total Number of Students on Presentation (UK wide)
Presentation October to March 2021J	32	1284	40.13	2.82	455	3102
Presentation April to September 2022D	11	274	24.9	0.9	305	3281
Information Technology Course 2	No of recordings in Cluster	Total Number of Views	Mean number of Views per Recorded tutorial (Views/recordings)	Mean number of Views per Student (Views/Student)	Total Number of Students in R11 (Scotland)	Total Number of Students on Presentation
Presentation October to March 2021J	18	643	35.72	2.47	260	1902
Presentation April to September 2022D	14	563	40.21	1.84	305	2199
Web Technology Course 1	No of recordings in Cluster	Total Number of Views	Mean number of Views per Recorded tutorial (Views/Recordings)	Mean number of Views per Student (Views/Students)	Total Number of Students in R11 (Scotland)	Total Number of Students on Presentation
Presentation October to June 2021J	24	1100	45.83	6.43	171	1408

The figures seem to suggest that there is value in the tutorial recordings to students. This is shown by the fact that each recording is viewed a number of times (View/Recordings). Looking at the total number of students there is some indication that each student may be viewing at least one recording (Views/Students). So, the figures suggest value to the student but do not state what that value is. Further investigation in the form of a focus group would be needed to ascertain the perceived benefit. More detailed analysis involving the date of access of the recording may reveal motivations such as preparation for an assessment. It is interesting to note that the number of views seems to be higher in the winter presentation in comparison to the summer presentation.

The figures do invite further investigation and it also seem natural to ask if the number of views increased during the COVID period as a result of lockdown requirements. This will require access to historical data to establish some form of baseline level.

5. Conclusion/discussion

A tutorial session is by its nature discursive and to be successful requires students to work interactively in order to address the questions that were posed in order to discuss possible answers. Depending on the nature of the question set, the question may have a specific solution or a range of possible solutions. Although technology provides for easier recording and distribution of recordings, the record everything aspect is adding to the volume of material available to students.

Lambie and Law (2018) identified that Tutor/Student interaction can be viewed as a two dimensional continuum. Figure 2 is a modified version of this continuum which seeks to include the role of a recording as part of the reflective process. Lambie and Law (2018) focused on interaction in an online tutorial primarily for distance learning students. A further aspect of being an active student and a reflective learner would include a review of the tutorial session recording which provides a further opportunity for reflection on the topic being considered. The argument here then is that recording the tutorial session could be viewed in a positive light rather than in a negative context of an opportunity to watch the session because the live session was missed. To make this a positive act the role of recordings should be discussed with the student body and built into the activities as part of a module which is typically in the region of 2 hundred hours of student effort.

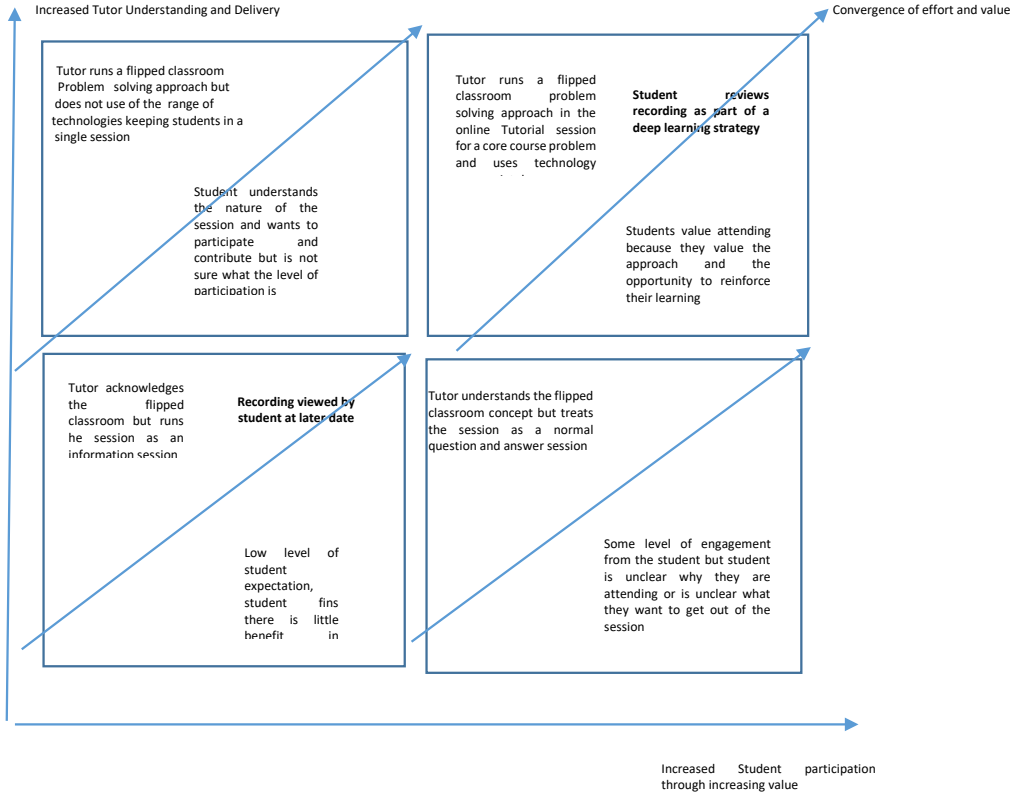

Figure 2: Attitude and engagement interaction

This approach would seek to show there is specific value on using the recording rather than just as an opportunity to catch up on a missed event and that reflection on presented ideas is part of developing independent critical thinking which is line with the ethos of the Oxford tutorial.

Having discussed the role of online tutorials in relation to the classic Oxford tutorial approach the key question here is how recorded Tutorials are being viewed. Are they an alternative to attending the live session or are they a way of being able to go back over the material covered in the tutorial. Viewing a recording asynchronously negates the ability to discuss topics directly, however recordings may provide other opportunities as discussed.

To this end, there is scope for investigating the relationships between:

- The number of live tutorials for a particular module
- The number of students attending the live session of a particular tutorial
- The number of views of a recording of a particular tutorial that was delivered live

Do students who attend a live session also view the recorded session? Perhaps they also view a session recorded by a different Tutor. The authors have started to pursue accessing this information which is recorded but not directly available to members of academic staff. This investigation may shed some light on the value the modern student gives to tutorial recordings and provide evidence for producing material in a particular format either as an alternative to a live session or as a means of supplementing live sessions to support deeper learning.

References

Balwant, R.J. and Doon R. (2021) 'Alternatives to the conventional "Oxford" tutorial model: s scoping review', International Journal of Educational Technology in Higher Education, Vol. 18 (1) pp 1-24

Beck, R.J. (2007) 'Towards a Pedagogy of the Oxford tutorial', p. 26.

Bond, M. et al. (2020) Mapping research in student engagement and educational technology in higher education: a systematic evidence map. *International Journal of Educational Technology in Higher Education*. [Online] 17 (1), 1–30.

Bowler, M. and Raiker, A. (2011) 'Learning to chat: Developing a pedagogical framework for facilitating online synchronous tutorial discussion', p. 11.

Gwebu, K. (KB) *et al.* (2021) 'Learning Communities: A Sound Investment in Higher Education', *Journal of College Student Retention: Research, Theory & Practice*, p. 152102512110677. Available at: https://doi.org/10.1177/15210251211067714.

Hudson, R. and Luska, K.L. (2013a) 'Recording Tutorials To Increase Student Use and Incorporating Demonstrations To Engage Live Participants', *Journal of Chemical Education*, 90(5), pp. 527–530. doi:10.1021/ed300497g.

Hudson, R. and Luska, K.L. (2013b) 'Recording Tutorials To Increase Student Use and Incorporating Demonstrations To Engage Live Participants', *Journal of Chemical Education*, 90(5), pp. 527–530. doi:10.1021/ed300497g.

Lambie, I., Law, R. (2015) 'The 21st Century Tutorial' In Proceedings of the 14th European Conference on E-Learning, University of Hertfordshire Hatfield, UK pp 299-304.

Lambie, I., Law, R. (2016) 'Using the E-Learning Acceptance Model (ELAM) to identify good practice in the provision of online tutorials.', In Proceedings of the 15th European Conference on E-Learning, Charles University, Prague. pp 299-304.

Lambie, I and Law, R. (2017) "Factors affecting Student attendance at online Tutorials in TU100 My Digital Life" , paper presented at European Conference on E-Learning (ECEL), Porto, 26th-27th October

Lambie, I and Law, R. (2018) "Tutor Perception of Delivery Mechanisms for Online Tutorials" paper presented at European Conference on E-Learning (ECEL), Athens 1st -2nd November

Lambie, I (2018) A review of Pedagogical Support for Online Learning in the 21st Century "Please State the Nature of the Educational Emergency!" paper presented at European Conference on E-Learning (ECEL), Athens 1st -2nd November

Law, R and Lambie, I (2020) "Encouraging Student Participation in Online Tutorials: A Tutor's perspective. *In* Proceedings of the 2020 ACM Conference on Innovation and Technology in Computer Science Education (ITiCSE '20). Association for Computing Machinery, New York, NY, USA, 525–526. DOI:https://doi.org/10.1145/3341525.3393991

Lambie, I and Law, R (2020) 'Teaching online during a pandemic – pedagogical skills transfer from face to face support to online synchronous provision' paper presented at European Conference on E-Learning (ECEL), Berlin 28th-30th October

Lambie, I and Law, R (2021) 'Peer Observation and Evaluation of Synchronous online Tutorials' paper presented at European Conference on E-Learning (ECEL), Berlin 27th-29th October

Llamas-Nistal, M. and Mikic-Fonte, F.A. (2014) 'Generating OER by Recording Lectures: A Case Study', *IEEE Transactions on Education*, 57(4), pp. 220–228. doi:10.1109/TE.2014.2336630.

MacKay, J.R.D. (2019) 'Show and "tool": How lecture recording transforms staff and student perspectives on lectures in higher education', *Computers & Education*, 140, p. 103593. doi:10.1016/j.compedu.2019.05.019.

Module Evaluation Survey (2022) "End of Module Student Satisfaction Survey for Mobile Platform Development", Glasgow Caledonian University

Nordmann, E. *et al.* (2019) 'Turn up, tune in, don't drop out: the relationship between lecture attendance, use of lecture recordings, and achievement at different levels of study', *Higher Education*, 77(6), pp. 1065–1084. doi:10.1007/s10734-018-0320-8.

Palfreyman, D. (Ed.) (2001). The Oxford Tutorial. Oxford: Blackwell's.

Palfreyman, D. (2001). The Oxford Tutorial: Sacred Cow or Pedagogical Gem? In D. Palfreyman, Ed., The Oxford Tutorial (pp. 1-28). Oxford: Blackwell's.

Syynimaa, N. (2019) 'Does Replacing Face-to-face Lectures with Pre-recorded Video Lectures Affect Learning Outcomes?':, in *Proceedings of the 11th International Conference on Computer Supported Education*. *11th International Conference on Computer Supported Education*, Heraklion, Crete, Greece: SCITEPRESS - Science and Technology Publications, pp. 454–457. doi:10.5220/0007744804540457.

Reinforcement Measures for Sustaining the Integration of Innovative Teaching and Learning Technologies in Selected Tanzanian Universities

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Abstract: Whereas the integration of innovative technology in facilitating learning is crucial in higher education institutions (HEIs), its sustainability has been a challenge, especially in developing countries. This paper reports the findings of a qualitative study that explored academic leaders' views, perceptions and experiences on sustainability strategies for the integration of innovative teaching and learning technologies (ITLTs). The paper contributes empirically to the educational discipline by developing a deeper understanding of specific strategies for the sustainability of the ITLTs integration in HIEs. Specifically, the study examined reinforcement measures related to rewards, culture, policies, and capacity building used by academic leaders for the integration of ITLTs in the selected Tanzanian universities. Secondly, the study looked into the perceived level of importance regarding attribute to effective integration of ITLTs in the respective universities. A semi-structured interview was used to collect data among 13 academic leaders from two public universities. Lewin's change management model guided the study in theorising and analysis of the findings. Thematic-deductive analysis revealed that most participants favoured capacity building strategy reinforcements. Meanwhile, implicit policies were reported to have a higher positive likelihood of enhancing the sustainability of effective integration of ITLTs. Concerning rewards, in-house training and recognition for what academics do were regarded as favourable strategies. Additionally, participants reported that the culture of offering directives and communication through online platforms has promoted the integration of ITLTs. Lastly, the capacity building and policies were vital on enhancing effective integration of ITLTs. There is a need to strengthen ITLTs policies development, rewards, and capacity building strategies for more effective and sustainable integration of ITLTs. This further supports the cultural transformation of ITLTs usage among academics in universities.

Keywords: innovative technology, blended learning, rewards, culture, sustainability, reinforcement measures

1. Introduction

Reinforcement measures for change are also regarded as the sustainability for change strategies in organisation. Armstrong (2016) argues that reinforcement measures for technological change are potential for maintaining acceptable way of doing things. These measures ensure solidification of new behaviour as a norm and if skipped, people in the organisation may get back to their traditional way of doing things (Will, 2015). Sustainability of technological change in education is one of the most prominent challenge higher education and that its failure leads to various negative education outcomes. For instance, a relatively low usage of innovative teaching and learning technologies (ITLTs) is still a significant challenge to most Tanzanian public universities as it also impacts the sustainability of ITLTs (Landa, Zhu & Sesabo 2021).

However, while there has been some research on various reinforcement strategies and their impact on the use of ICT in education (Jacobsen, 2013; Ward, 2013), most do not explicitly trace academic leaders' experiences rather than instructors'. Subsequently, a few studies have investigated academic leaders' perceptions of such experiences relating to sustainability of ITLTs. Studies indicate that academic leaders plan for instructors' development, participate in their development sessions, provide feedback about their performance, praise and encourage instructors to integrate technology (Heintzelman 2017), therefore, knowing how they reinforce ITLTs is paramount. Furthermore, a study by Savelyeva & Lee (2012) pinpointed that, academic leaders engage the instructors in formal and informal development opportunities to learn how to integrate technology into classroom curricula. The results of such academic leadership support lead to clear expectations for students, provide direct instruction, and guide technology integration (Heintzelman 2017). As such, this study explores academic leaders' perceptions and experiences with reinforcement measures on the integration of ITLTs so as to develop deeper understanding and specific strategies towards supporting effective implementation and sustainability of ITLTs-integration in Tanzanian universities.

2. Reinforcement measures for the integration of ITLTs in higher education

The integration of technology in teaching and learning is crucial in higher education. Worldwide, the integration of ITLTs has been growing rapidly due to many factors including technology advancement. Its acceptable benefits globally lead scholars to find out how can educational institutions support it or keep it going smoothly. "Indeed, it is argued that several conditions need to be fulfilled if technology is to serve as a benefit, and not an obstacle to learning, and thus boost the delivery of quality education" (Danniela et al., 2018).

A previous study by Terry (1997) suggested that reinforcement measures are to be encouraged within the HEIs' for maintaining and sustaining any commitments that support instructional technological innovation. His study put forth on mechanisms such as formal policies, development programmes and rewards for sustaining ITLTs. Other studies (Nworie 2014; Marienko et al., 2020) add up that effectiveness of technology use in instruction could be evaluated on its continuous sustainability measures that leaders are putting forth.

Despite the low uptake of ITLTs integration evidenced in most developing countries such as Tanzania, HEIs are also struggling to put in place various strategies to support sustainable use of ICT in education. A study by Katundu (2008) shows that, measures for sustaining ICT use in education are important in Tanzanian higher education for facilitating effective local planning and development of technology integration. However, the same study further argued that efforts were not made to sustain the innovation to ensure continued integration of ITLTs.

Besides, to encourage sustainability and continuous integration of innovations in teaching and learning, suggestions are made on systems, structure and supported strategies that enable the sustainability and widespread adoption of instructional innovations (Dinh, 2021). The findings reported by Savelyeva and Lee (2012) identify school cultural promotion, focusing on students' needs, respondent's commitment, and willingness of the leaders as necessary attributes for sustaining technological innovations in education. Accordingly, Zayim Kurtay and Zhu (2019) coincide in the view that college leadership should apply long-range plans for updating technologies in teaching and learning through leadership. Only a few theoretical studies have focused on sustainability measures to integration of ITLTs, literature is limited to how sustainable integration of ITLTs- can be achieved through academic leadership, which is also a case in Tanzanian HEIs.

Considering such a background, this study explores academic leaders' perspectives on reinforcement measures for the integration of ITLTs. The research questions (RQs) are as follows: What reinforcement measures related to rewards, culture, policies and capacity building are used by academic leaders for the integration of ITLTs in the selected Tanzanian universities? (RQ1); and What is a perceived level of importance regarding reinforcement measures in which academic leaders attribute to effective integration of ITLTs in the selected Tanzanian universities? (RQ2). Thus, the study empirically contributes to the education by developing deeper understanding of specific strategies towards supporting sustainability of the effective implementation of the ITLTs integration in higher education in Tanzania. This study follows Lewin's change management model which determines the sustainability strategies for enhancing innovative use of ITLTs(Armstrong 2016). The models entail that sustainability measures ensure solidification of new behaviour as a norm. Thus, it involves careful attention to support strategies including incentives, policies and guidelines, capacity building and developmental of organizational culture (Armstrong 2016).

3. Methods

3.1 Participants

This study adopted qualitative research design. Thirteen (13) academic leaders from two public universities in Tanzania were interviewed. These included heads of departments, faculty/school deans, directors, principals, , e-learning, and academic coordinators. Jing & Yao (2019) description of academic leaders as the personnel with formal managerial responsibilities who exhibit leadership in academic activities was adopted. Participants' age varied from 33-58, while the majority were male (60%). Their Leadership experience ranged from 2-15 years.

3.2 Data collection and analysis

Semi-structured interview was conducted to 13 academic leaders. In this, participants were selected from distinct levels of academic leadership based on their knowledge on integration of ITLTs. Participants' consent was sought through an invitation email sent to the selected academic leaders. Each interview lasted for 30-40 minutes and was audio recorded, then transcribed. Interviews were either conducted in Kiswahili (then translated to English) or directly in English. Further, participants were given an opportunity to go through the questions prior to the interview. The transcribed interviews were shared to the last author for reviewing and comparing the notes with those of the first author for ensuring inter-rater reliability (Miles et al., 1994). This enabled the authors to have a common understanding on the transcribed data.

The thematic-content analysis was used. Since the study adopted the Lewin's change management model to explore reinforcement measures for sustaining technological change in education based on the main four issues related to rewards, policies, capacity building and culture, a deductive approach was employed. The principal codes were guided by the four major reinforcement measures of the model. Transcribed texts extracted; sub-codes were marked while the codes frequencies for the emerged themes were quantified.

4. Results

In this part, the results are presented with respect to the main strategies of sustainability of change, based on the interviews with the academic leaders. Subsequently, we focus on the analyses regarding what reinforcement measures related to rewards, culture, policies and capacity building were used by academic leaders for the integration of ITLTs. Then, we assess the perceived importance of the strategies used.

4.1 Reinforcement measures employed for the integration of ITLTs (RQ1)

Regarding rewards, academic leaders were asked on what motivates their academic staff to integrate ITLTs under their leadership, that is whether the availability and type of rewards they use affect ITLTs-integration among academic staff. Most participants mentioned in-house training. The participants contended that the 'hands-on' in-house training are the most current critical motivator for both new and old academics. They also mentioned recognition as another rewarding factor which motivates their academics to integrate ITLTs. However, they declared that financial incentives could impress staff quite well.

Concerning culture, academic leaders were asked whether the relationship they have with academic staff, affects integration of ITLTs in teaching and learning. The majority reported to have both formal and informal relationship which influenced academic staff use of ITLTs. Formal relationship mostly occurred during meetings geared to improve the integration of ITLTs among staff. More than half of participants (n=9) reported to use various platforms such as departmental/faculty/school/college meetings, boards to inform and advocate ITLTs integration matters to their staff. Additionally, the culture of using online systems in handling either various matters was promoted due to use of ITLTs. Some participants indicated that paper-based administrative operations related to 'requesting for permission' was discouraged, if that administrative culture has changed, academic leaders hoped for the use of ITLTs could likewise change. On this aspect, one participant responded, "For now, we discourage the use of physical letters, yes we get advance to promote for instance online leaves applications …a thing that has started to develop and the people have started getting used to it. We also believe that these ed Techs will change." (Participant 4).

Relating to ITLTs policies, contradictory responses were revealed among participants. The participants were asked whether policies or/ and guidelines and their implementation supported or constrained their decisions in enhancing the integration of ITLTs. On this, only college principals and deans showed enough knowledge about what was going on regarding ITLT policies and how far they would provide them with a better way ahead. The perception was that ITLT formal policies once developed, they could more use of ITLTs in two ways. First, academic leaders could understand their roles while managing the use of ITLTs by their staff, and secondly, the use of ITLTs among staff might be higher and would further enhance the quality of delivery. One participant echoed:

> *"We have advocated also to a top university management, that these ways of teaching must be compulsory (policy), for example if a person wants to be planned to a subject, s/he must have learnt and use these ED -TECH platforms eLearning, zoom and also other ITLTs. (Participant 10).*

On the other hand, most heads of department and coordinators interviewed, kept on insisting to have only recommendation roles on matters related to the sustainability of ITLTs change through policies. On that regard, they claimed that policies on progress were not communicated to them yet. However, the majority of participants agreed that they just followed guidelines or directives from the top management. Unpredictably, some of the programme coordinators claimed not to have been actively involved in academic staff issues regarding the use of ITLTs. They reasoned that lack of involvement in decision making was due to absence of policies or guidelines or the silence of the guidelines regarding their specific roles on matters related to that.

On the issue of capacity building, participants expressed various effort they employ to capacitate academic staff towards the integration of ITLTs. Most academic leaders reported that academic staff were encouraged to attend both offline and online training programmes. Additionally, sharing experiences among staff who have ITLT prior knowledge was another way used to capacitate staff. ITLTs training was more emphasised and is currently among the strategic priority to their departments and faculties. They further insisted that training on technical side of the ITLTs is much crucial to their staff. However, the collective results show that training on both technical and pedagogical use of ITLTs was perceived as highly needed by their staff and need to supported by academic leaders. One participant mentioned: "These things if you don't have their ABCD, it is tough for you to follow them up and also to convince for others." Academic leaders should be ICT-literate… (Participant 5).

Nevertheless, most participants reported that, due to some barriers such as workload, lack of incentives, transport issues among others, some staff could not attend the training effectively.

4.2 The perceived level of importance regarding the reinforcement measures for effective integration of ITLTs (RQ2)

Regarding the second research question, academic leaders were questioned to provide the sustainability strategies that they thought were specifically attributed to the effective integration of ITLTs and how those strategies facilitated effective integration of ITLTs at their leadership level. Four dimensions referring to capacity building, rewards, policies and culture were given out for discussion during the interview. The results indicated that, the majority of participants (n= 11) mentioned capacity building as a highly needed strategy that could simplify leadership of ITLTs integration. Indeed, most emphasis was put on training, that is, 10 out of 13 participants mentioned it as a big factor leading to use of ITLTs. Firstly, through capacitating staff that their transformation could be easier e.g. one leader expressed her idea by saying that:

> *… "Skills on ITLTs are important because all of these depend on a person's ability and understanding of ICT Someone with such skills does not need us to use so much time and effort to transform him/her".*

Secondly, it was suggested that academic leaders should have their respective courses to promote their understanding of the teaching and learning technologies probably even more than academic staff. Academic leaders' competence seems most essential in accelerating confidence, while facilitating the use of ITLTs among their staff. They argued that academic leaders should be competent and knowledgeable, for them to lead others. With this regard, investment on ITLT capacity building is essential. One participant stressed that "if you are a leader, you can't direct something you don't know, I must promote something I understand". ITLTs training programmes were mostly perceived important to academic leaders to, a) have sufficient competence that creates awareness on the use, b) influence others to use them too, c) influence the budget related to the use of ITLTs, d) influence attitudinal change.

Next to capacity building through training, participants (n=10) mentioned ITLT policies as the second strategy that led to effective integration of ITLTs at meso level. Likewise, almost all (n=9 out of 10 participants above) explicitly suggested that institutional ITLT policies should have their back-up at macro or national level. These participants put forward two reasons for that. Apparently, it could accelerate the leaders' confidence in managing the integration of ITLTs and second, it could sharpen the transition into the new implementation of technological change in public universities to facilitate an effective use of ITLTs. Policies have been seen as influential in avoiding both staff and students' claims. "We can't allow our staff to even record and upload their voice in classroom because the policy does not allow…here I mean we have no policy of that kind because if a teacher uploads it there, students will complain." (Participant 3).

In connection to this, the results further indicate that having policies would show a clear directive and mandates among academic leaders. It was revealed that, only ICT policy [at national level] is not enough for the implementation of ITLTs. It was also reported that policies would help to avoid harassment to teachers against the use of ITLTs compared to the use of guidelines or directives only:

> *"… there are some teachers who are scammers. In some cases, a teacher may take what is recorded this side and give it to students without checking the content very well…" (Participant 9)*

Based on the analysis explained in this category, it is evident that policies and capacity building can influence each other. It was noted that leaders mostly establish a certain training depending on the focus or vision of the institutions:

> *"Administrations can drive their workshop … To run training to people let's say five or twenty. …But all in all capacity building corresponds with policy that is there for the university i.e. the focus… (Participant Pos. 427-430)*

Although majority agreed that rewards are crucial for effective integration of ITLTs. However, they stressed that with the urgency vis a vis infant stage of using ITLTs in their universities, financial rewards should only slightly come along with the implementation of such changes. No need to put many efforts on that for the time being.

5. Discussion and conclusion

The current study presents academic leaders' views and experiences on the reinforcement measures for enhancing effective integration of ITLTs in public universities in Tanzania. The measures have been conceived within four broad strategies related to policies, capacity building, rewards and culture. Overall, the results confirm that all participants were familiar with the referred sustainability strategies. However, a number of challenges have been noted.

Firstly, in view of research question one, the study revealed that capacity building was the mostly used strategy on enhancing the integration of ITLTs. In line with Al-Zahrani (2015) findings, respondents acknowledged that training was a vital measure to be considered, thus capacity building programmes have to morally and financially supported to accelerate the integration of ITLTs. This implies that to sustain integration of ITLTs, academic leaders need continued training for obtaining skills and building confidence to support others. Previous studies show that training is a critical managerial determinant of successful sustainable implementation of ITLTs (Palvia et al., 2018). Also, training could facilitate the creation of good environment for staff to learn and use ITLTs, something that is also supported by the study by Elly (2014).

Next to the training is policy. Bansal (2017) and Palvia (2018) mentioned ITLT-friendly policies as the major driver for online and blended education. The current study reported no formal policies to guide the integration of ITLTs, rather guidelines or directives influenced ITLT managerial operations. This was a crucial barrier for supporting effective integration of ITLTs by academic leaders. Contrary, to the study by Tondeur (2008) reported that explicit policies which include guidelines, stress shared goals influenced the use of ICT more regularly in classroom. Perhaps, the contradiction is due to the context and culture of organisations studied. Most public university leaders in Tanzania have normally been guided by implicit policies that are later supported by the explicit ones. However, in February, 2022, Tanzania introduced formal guidelines for guiding the integration of ITLTs in HEIs (TCU, 2022).

Nevertheless, the participants put forward lack of communication within the meso-level leadership when it comes to the initiatives of ITLT policy making process. In particular, most coordinators seemed overlooked during the development of ITLT- related decisions. The results pointed out lack of awareness and inclusion among most coordinators on the ongoing initiatives of ITLTs policy development in universities. These practices do not comply with policy making models which normally reinforce the inclusion of every stakeholder during the process. Porter etal (2016) asserts that e-learning policies development has to exist in respective education institutions whereas awareness and compliance with the policies prevail among stakeholders. Similarly, Katundu (1998) and Savelyeva & Lee (2012) emphasise that having a voice of all stakeholders in decisions and resolutions influence success of educational innovative technologies. Thus, adds up to the three indicators of discretionary behaviour related to the empowerment of participants (Lincoln & Guba 1985) on the relevance of involvement of all participants and not capturing only the opinions of the superior leaders and most experienced participants.

Responses to the second research question highlight the perceived level of importance regarding the reinforcements used by academic leaders for sustaining integration of ITLTs. The findings revealed that sustainability measures which consisted of capacity building and policies were identified as the most vital attributes in which academic leaders perceived as useful in enhancing effective ITLTs integration. On the one hand, this finding concurs with the study of Ryan et al, (2014) in which the authors reaffirm that capacitating staff through training of different kinds is important for leaders to manage the transformation of their academic staff in using ITLTs. On the other hand, regarding policies, the results are highly correlated with previous research in which policies were found to be an important factor for improving ITLTs decision making. (Ciabocchi et al., 2016; Anthony 2016). Future studies should assess the sustainability measures associated with effective ITLTs integration where the ITLTs use is high.

6. Significance, implications and limitations

This study was guided by Lewin's Change Management Model to explore reinforcement measures for sustaining technological change in education based on the main four strategies related to rewards, policies, capacity building and culture. This model envisions that sustainability measures ensure solidification of new behaviour as a norm. The model has provided a solid foundation in explaining the results that academic leaders found new behaviours such as the use of internet as a communication tool as a normal strategy on enhancing use of ITLTs. Furthermore, strategies such as training as a form of capacity building, policies and rewards were confirmed to have an impact on the use of ITLTs. On a practical level, the findings of this study provide empirical evidence that capacity building and policies are key when it comes to influencing use of ITLTs in higher education. This means, higher education institutions have to set good policies and continue training their staff for sustainability of ITLTs. Overall, the study implies that policies, training, rewards and culture, are important strategies though have varying levels of significance to academic leaders.

Regarding limitations of the current study, only mid-level academic leaders were involved, thus limiting the understanding to this particular group leaving out other academic leaders in the meso-level. Lastly, determination of what constitutes important strategies about the reinforcements used by academic leaders for sustaining integration of ITLTs was based on leaders' perceptions. This limits the study in the sense that only what was perceived as important, has been listed. This tends to neglect the fact perceptions are influenced by a number of other factors, which may have influenced the results.

References

Agarwal, H. and Pandey, G.N., 2013. *Impact of E-learning in education*. International Journal of Science and Research (IJSR), 2(12), pp.146-147.

Alänge, S. and Steiber, A., 2009. The board's role in sustaining major organisational change: An empirical analysis of three change programmes*. International Journal of Quality and Service Sciences*.

Al-Zahrani, A.M., 2015. *Enriching professional practice with digital technologies:* faculty performance indicators and training needs in.*Instructional Technology*, *44*.

Armstrong, M., 2016. *Armstrong's handbook of management and leadership for HR: Developing effective people skills for better leadership and management*. Kogan Page Publishers.

Calabrese, R.L., 2002. *The school leader's imperative: Leading change*. *International Journal of Educational Management*.

Ciabocchi, E., Ginsberg, A. and Picciano, A., 2016. *A Study of Faculty Governance Leaders' Perceptions of Online and Blended Learning. Online Learning*, *20*(3), pp.52-73.

Daniela, L., Visvizi, A., Gutiérrez-Braojos, C. and Lytras, M.D., 2018. *Sustainable higher education and technology-enhanced learning (TEL). Sustainability*, *10*(11), p.3883.

Daniels, J., Jacobsen, M., Varnhagen, S. and Friesen, S., 2013. *Barriers to systemic, effective, and sustainable technology use in high school classrooms. Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie*, *39*(4).

Dinh, N.B.K., Caliskan, A. and Zhu, C., 2021. *Academic leadership:* Perceptions of academic leaders and staff in diverse contexts. Educational Management Administration & Leadership*, 49*(6), pp.996-1016.

Duyar, I. and Normore, A.H. eds., 2012*. Discretionary behaviour and performance in educational organizations: The missing link in educational leadership and management*. Emerald Group Publishing.

Fredberg, T., Norrgren, F. and Shani, A.B.R., 2011. *Developing and sustaining change capability via learning mechanisms:* A longitudinal perspective on transformation. In *Research in organizational change and development*. Emerald Group Publishing Limited.

Heintzelman, S.C., 2017. *Integrating technology to engage students with EBD:* A case study of school leader support.

Katundu, D.R.M., 2008. *The use and sustainability of information technology (IT) in academic and research libraries in Tanzania* (Doctoral dissertation).

Mantel, M.J. and Ludema, J.D., 2004. *Sustaining positive change: Inviting conversational convergence through appreciative leadership and organization design.* In *Constructive discourse and human organization*. Emerald Group Publishing Limited.

Marienko, M., Nosenko, Y., Sukhikh, A., Tataurov, V. and Shyshkina, M., 2020. *Personalization of learning through adaptive technologies in the context of sustainable development of teachers education. arXiv preprint arXiv:2006.05810*.

Miller, D., 2004. *Building sustainable change capability. Industrial and Commercial Training*.

Nworie, J., 2014. *Developing and Sustaining Instructional and Technological Innovations in Teaching and Learning. Journal of Applied Learning Technology*, *4*(4).

Savelyeva, T. and Lee, Y., 2012. *Nature of leadership discretions and sustainability of educational innovations: Critical connections.* In *Discretionary behavior and performance in educational organizations: The missing link in educational leadership and management*. Emerald Group Publishing Limited.

TCU, 2022. *Guidelines for online and blended delivery modes of courses for university institutions in Tanzania.* Tanzania Commission for Universities. Dar es Salaam.

Tondeur, J., Van Keer, H., Van Braak, J. and Valcke, M., 2008*. ICT integration in the classroom: Challenging the potential of a school policy. Computers & education*, *51*(1), pp.212-223.

Ward, D., 2013. *Sustaining Strategic Transitions in Higher Education*. *Educause Review*, *48*(4), p.12.

Technology in the Pandemic: Rupturing the Aura of Higher Education

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Abstract: Framed by Benjamin's (2008) concepts of aura, technological reproduction, and miniaturization, this paper argues that technology provides students with greater opportunities to take control of their learning in ways that were not possible when education took place largely on-campus, in the higher education classroom. Post pandemic, digital technology has influenced, and will further impact, the way in which we teach and communicate with our students. Educators emerging from pandemic pedagogies need a deeper understanding, and more judicious and effective use of technologies for learning. By understanding and using technology in these ways, educators can help students become more empowered, collaborative, and critically reflective. A lack of readiness for emergency online learning has been replaced with a sense of acceptance that educators must incorporate digital tools into their practice for both educational and communicative purposes. This means that our intellectual and social attachment to the physical classroom as a place for learning and communicating is not as strong as before. Far from being a eulogy for the physical classroom, this paper aims to interrogate the proliferation of technology, and the broad implications for higher education. It argues that the use of technology may help diminish the historical power and aura of higher education and intellectual pursuits, thus undermining the traditional overt and covert control of the institution as an ideological state apparatus. Nevertheless, this shifting educational landscape brings new challenges and questions about the historical aura of higher education, and the concomitant evolution of teacher student relationships and power structures through technology implementation. While maintaining optimism about educational technology, this paper urges educators to consider the broader context of our educational settings, and argues for prioritising critical engagement with technology that aims to utilise its potential for collaboration, empowerment and critically reflective inquiry.

Keywords: technology, higher education, critical theory, reflective inquiry

1. Introduction

Walter Benjamin's interwoven concepts of aura, technological reproduction, and miniaturization (Benjamin, 2008; Johannßen, 2018) provide a helpful lens through which to view the recent pedagogical adoption of, and adaptation to, digital technology both during the pandemic lockdowns and in their wake. This paper argues that the trauma of the pandemic and the ensuing rush to teach via digital technology has led to a yearning for the physical classroom. This is both a sign of unpreparedness and indicative of the aura institutions of higher education have in the eyes of students and teachers. However, it also signals a critical juncture for education, bringing into question the nature of educational institutions, their hierarchies and the roles individuals play within. Central to these theoretical concerns is the shifting landscape of education from the classroom to digital technology-mediated learning. While this shift has been in progress for a number of decades, the recent COVID pandemic brought digital technology use into sharp focus. The pandemic has thrust digital technology upon many educators, leading to the incorporation of online learning ranging from fully asynchronous online courses to blended, hybrid and hyflex learning. This shift requires different pedagogical approaches as different means of communication and interaction are now more common. Developing online communities through the Community of Inquiry (CoI) (Garrison, 2022) and Fully Online Learning Community (FOLC) (van Oostveen et al, 2016) models can facilitate collaborative learning and student engagement in online spaces, and critical analyses of a given learning context. They also provide relevant frameworks to maximize the utilization of digital technologies, which allow students to miniaturize large quantities of data, thus allowing them to exercise more agency over information critical to their learning.

2. Theoretical framework: Benjamin's notions of aura, technological reproduction and miniaturization

Benjamin's (2008) interconnected concepts of aura, technological reproduction, and miniaturization (Johannßen, 2018) can help shed light on how technology impacts education while allowing educators to interrogate how things beyond education have a lasting impact.

To understand the impact of technology on education, it is helpful to outline Benjamin's (2008) concept of aura. For Benjamin, aura is a "gigantic anthropomorphism" (Johannßen, 2018, p.645), meaning the object containing the aura seems to be returning the viewer's gaze, thus generating a relationship between the viewer and work of art (Snir, 2021). This aura invests in the work of art a certain authenticity, or power. However, while Benjamin's (2008, pp.7) focus was on the mechanical reproduction of art, he saw technology's impact on art as being symptomatic of something much larger. This means the idea of aura can be extended to the physical world, whether natural or human-made wonders, or when one stands in locations previously occupied by key historical figures (Snir, 2021). What is key to this notion of aura is that objects, institutions, social roles, and positions of authority appear untouchable, unapproachable and impossible to appropriate when encapsulated by aura. Therefore, it is not difficult to imagine this being extended to educational institutions, authoritative figureheads, or even the pursuit of knowledge.

Benjamin (2008) posited that the reproduction of art through technology had an irreversible effect on the perception of art. He explained that the authenticity of an original work of art would always be lost through reproduction. Although reproduction of art by hand was commonplace, technological reproduction had the new ability to undermine the authority of a work of art through its independence from the original, and by the way technology can reproduce art widely, in different settings (Benjamin, 2008, p.21). Of particular relevance to education and its institutions, Benjamin wrote, "The cathedral leaves its site to be received in the studio of an art lover; the choral work performed in an auditorium or in the open air is enjoyed in a private room" (Benjamin, 2008, p.22). To bring this even closer to online, distance or even hybrid education, Benjamin (2008) emphasized the role of technology in severing objects' connections to tradition and exclusivity.

In order to connect Benjamin's (2008) notion of aura and technological reproduction to digitization and digital technology in education, it is important to consider the concept of miniaturization. Johannßen (2018) makes explicit the link between Benjamin's work and modern digital technology. Identifying cellphones in particular, he highlighted the ability we have to collect, store and assess information on modern devices, which he argued miniaturizes the world. Benjamin's work identifies technological reproducibility as having emancipatory potential, (Johannßen, 2018, p. 639), and he identified the expansion of the press as an illustrative example (Benjamin, 2008, p.33). Benjamin pointed out that, for ages, literature was controlled by a select few. However, with the growth of the press, particularly journals, readers could become writers and contribute to various publications. The technological advancements behind this shift in power allowed readers to interrogate and miniaturize ideas. What is evident here is the essential "twofold nature of miniaturization as an unconscious perceptual response and a decentering technique of reading and writing" (Johannßen, 2018, p.643). That is, the new technology of the printing press led to an irreversible change in perception of the "axiomatic character" of the distinction or relationship between writer and public (Benjamin, 2008, p. 34-35). Leading on from this, as Johannßen (2018) has argued, newer digital technologies offer more approaches to miniaturization, and this is a necessity considering the rapid expanse of populations and increasing urbanization. Ultimately, miniaturization through digital technology can aid learning by condensing down or organizing vast collections of information (e.g. datasets), thus enabling learners to take greater control over what may be mentally or emotionally strenuous amounts of information (Johannßen, 2018).

Considering digital technology's potential to miniaturize the world, educators have the potential to develop curricula, course outlines and lessons that help learners overcome a reliance on educators and institutions as leaders, thus empowering them to be self-reliant, autonomous learners.

3. Context of issues: The trauma of the pandemic and yearning for physical classrooms

The return to on-campus learning should be considered as part of the process of pandemic pedagogy. The effects of various pedagogical approaches during these unprecedented times are still at the forefront of teachers' and students' minds. The haphazard rush to implement online learning has left students feeling dissatisfied and alienated, with many believing that in-class learning is more effective than online learning (Post-Pandemic Pedagogies, 2020). Many problems with online learning have become apparent over the last two years. There are concerns about building online communities, interaction between students and teachers, and a work/life balance (Schwartzman, 2020). Harouni (2021) has raised the issue of communication, particularly in synchronous online settings. He highlighted learning new communicative norms, sensory differences, and the absolute/hybrid space as specific challenges of online learning. He has also described the vanishability of online spaces, arguing that the temporal continuity of classrooms and school buildings is lost in online learning. He contended that

physical classrooms have the benefit of allowing students to mill about, ponder or exchange conversation that has a chance to taper rather than end abruptly. These points raise concerns about the potential of online learning to facilitate interaction and socialization between students and are borne out of the dramatic switch to online learning.

Even before the pandemic disrupted education, the physical setting of the school had been championed as a great leveller and place for positive interactions. The notion that in-class learning allows for more organic interactions and flow between the classroom and outside spaces betrays the freer and more fluid movement physical spaces offer, and this is the most distinct aspect of in-class learning. It is a point where social presence may be felt more strongly, where ideas can be exchanged outside of a specific lesson plan, and where spontaneity can happen. To elaborate, a lesson's before and after stages may provide students with even more of what Masschelein and Simons (2013) label as 'free time'. This offers a unique opportunity for students to be (ontologically) in the school, which can "give everyone, regardless of background, natural talent or aptitude, the time and space to leave their known environment, rise above themselves and renew (and thus change in unpredictable ways) the world" (p.10).

The scramble to adopt and adapt to new digital technologies after the initial lockdown put extreme pressure on educators and students and has understandably led to a yearning for the physical classroom (Post-Pandemic Pedagogies, 2020). This is reflective of the "quasi-religious adoration of the singularity of the object" (Johannßen, 2018, p.646) that comes as a result of its aura. However, as outlined by Johannßen (2018, p.645), Benjamin's initial interest in miniaturization identified it as a natural reaction to potentially traumatic experiences. Yet, in later works, Benjamin emphasized the importance of developing a more intentional miniaturization that aims to undercut the less rational tendency to reduce the stature of overpowering sensations (p.645). Therefore, educators should interrogate their adoption of and adaptation to various forms of digital technology in the wake of the pandemic. It is through this miniaturization that educators and students can address the aura of education, its institutions, and hierarchies.

4. Pedagogical approaches using technology

Definitions of online learning vary from asynchronous, synchronous, hybrid, blended, distance, mulit-modal, remote and hyflex. While these terms may describe fundamentally different pedagogical models, they also do not take into account critical factors in online learning success; factors such as student engagement, attrition, pedagogical approach and sense of community. The remote nature of online learning has resulted in isolation and discouragement, (Dabbagh & Kitsantas, 2004; Kizilcec & Halawa, 2015; Lehman & Conceicao, 2014) and often higher levels of attrition for online learners, and greater discouragement for online educators. There is also evidence that students learning online often feel isolated, leading to attrition rates up to 20% higher than face-to-face learning (Angelino & Natvig, 2009).

The more recent rapid shifts to online learning environments created a perfect storm of conditions, where teachers had to evolve, learning new technologies as needed, with little support from institutions and, in many cases, a sense of isolation from colleagues and resources. In some instances, this resulted in both resistance to the change to online learning modalities, as well as anxiety, discomfort and fearfulness of the transition. The learning and living conditions exacerbated by the pandemic crisis created a complex series of situations, revealing gaps in the traditional infrastructure of learning in higher education. Paradoxically, this also created opportunities, within which some individuals and organizations adapted well, while others struggled to meet the learning needs of adult students, often who had multiple responsibilities as parents, caregivers and employees. To successfully merge to an interdependent and integrated use of technology for learning, several essential factors intertwine and exist symbiotically. Cochrane (2012) identifies this unique sharing of the digital learning environment as one of the critical success factors in digital learning. He states that features of a successful virtual learning environment include

> *Pedagogical integration of technology into the course and assessment, lecturer modelling of the pedagogical use of the tools, creating a supportive learning community, and creating sustained interaction that explicitly scaffolds the development of ontological shifts that is the reconceptualization of what it means to teach and learn within social constructivist paradigms, both for the lecturers and the students (Cochrane, 2012, p. 125).*

Further, Flavin (2012) refers to "disruptive technologies" (p. 103). He states that "when digital technologies are brought into the classroom setting, the lecturer may have to relinquish some of their authority, thus impacting

on the 'rules' and 'division of labour' nodes in order to enable enhanced learning" (Flavin, 2012, p. 104). This revisits Benjamin's notions of aura, deconstructing historical notions of learning in higher education institutions, and creating learning environments that become more democratic, with shared roles and responsibilities, and a more balanced sense of empowerment for the learner. In this way, the historical notions of colleges and universities were dismantled, as technology made learning accessible anywhere, anytime, to anyone. Learners became more self-directed, and a chasm developed between what past models of higher education were, to what the pandemic had crafted.

4.1 Online learning communities

Wenger and Synder (2000) state that "online communities facilitate virtual collaboration among community members with the potential of transforming the activities of off-line into an online context" (in Lin & Lee, 2000, p. 480). Lin and Lee (2006) attest that "the online community can be defined as a social relationship aggregation, facilitated by internet-based technology, in which users communicate and build personal relationships" (p. 480). Kearney et al (2012) concur that learning "is a situated social endeavor" (p. 1). LittleJohn, Beetham and McGill (2012) agree that the social elements of learning are being embraced by students, and that "learners are responding to the new technical and social opportunities with little help from the formal education system" (p. 551).

In sum, the development of communities of learning has evolved. The Community of Inquiry (CoI) framework (Garrison, Anderson, & Archer, 2010) in particular, recognizes three presences essential to supporting distance education: Social Presence, Teaching Presence, and Cognitive Presence.

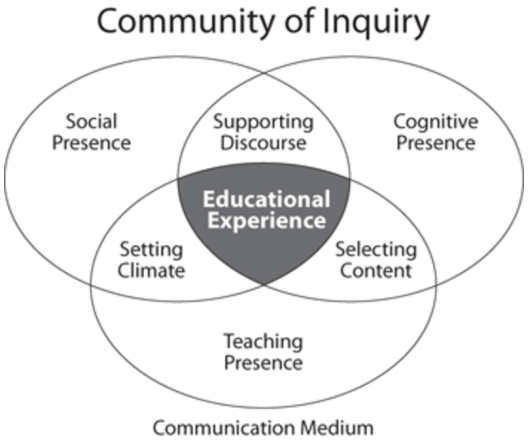

Figure 1: Community of inquiry (Garrison, Anderson, Archer, 2000)

Beyond this, the Fully Online Learning Community (FOLC) model contains social presence, cognitive presence and collaborative learning in a digital space. Significant to this model, there is no overarching teacher presence, but discernibly, the teacher presence is shared in an interdependent way where all members of the learning community are accountable to, and responsible for, the learning of the community members. Decisions are made collaboratively, assessment and evaluation are negotiated, and community members are encouraged to engage in critical discourse that challenges thinking, and involves both conjectures and refutations of ideas. It is this shared power in the community that deconstructs the old aura of higher education, and places learning squarely in the capable hands of adult learners; learners who arrive to the digital environment with lived experiences, skills, and competencies, and a context or experience that frames their learning. In essence, we are miniaturizing the learning experience to the learners' lived contexts, while simultaneously expanding their learning by shared collaborative experiences with others.

Figure 2: Fully online learning community (FOLC) model (vanOostveen et al, 2016)

4.2 Metacognition in online learning communities

In a broad sense, metacognition involves learners reflecting on their knowledge and becoming critically aware of how they learn (Flavell, 1979; Zimmerman, 2002), but Negretti (2012) and Ramadhanti et al. (2020) emphasize declarative, procedural, and conditional knowledge as distinct aspects of metacognitive awareness. Student awareness of these aspects points toward the development of metacognition (Ramadhanti et al., 2020), and supports its potential to improve self-regulated learning and self-efficacy, thus helping students miniaturize their learning experience.

Metacognitive tasks have demonstrated efficacy, particularly in writing and language courses (Negretti, 2012; Ramadhanti et al., 2020; Redwine et al., 2017). However, metacognition has historically focused on self-regulation and neglected collaboration, discourse and community learning (Garrison, 2022, p.7), each of which is integral to a CoI or FOLC framework. For Garrison (2022), metacognition should be viewed as a product of discourse within a shared learning environment, and co-regulation is as vital as self-regulation. Metacognitive activities have demonstrated efficacy in higher education when used in on-campus learning, and evidence points towards the value of a collaborative, shared approach to metacognition (van Oostveen et al, 2016). Groups who relied on metacognitive collaboration have often outperformed their non-collaborative and non-metacognitive counterparts in writing (Teng, 2021), and there is evidence that a causal relationship exists between collaborative metacognition and emancipatory, transformative learning (Boyer et al., 2006), whose potential also resides in the utilization of digital technology (Johannßen, 2018).

For Garrison (2022), teaching presence can boost metacognition (Garrison, 2022), but to facilitate greater agency, incorporating metacognitive prompts into activity design or the architecture of an LMS platform may be more effective (Scardamalia and Berieter, 2008). For Knowledge Forum, a CSCL system, Scardamalia and Bereiter (2008) implemented scaffolds for metacognitive processes that help students self-identify reflections. This, combined with a more intuitive design that appears more like a mind map than a traditional discussion forum, supports collaborative knowledge building (Hong & Scardamalia, 2014). Further to this, the CoI framework has demonstrated use in helping educators assess the types, levels and depth of metacognition taking place in online settings (Akyol & Garrison, 2011).

4.3 Collaborative metacognition and reflective journaling

Reflective journaling is a powerful tool for critical self-reflection, particularly when anticipating, experiencing, and recollecting events (Boud, 2001). Reflections from these different perspectives support deeper awareness, reflection-in-action, recall of experiences, focus on feelings and re-evaluation of our experience of a given situation (Boud, 2001). Boud (2001) focuses on reflection-in-action's potential to expose decision-making to scrutiny, expose assumptions, and form new perspectives from which to act. This involves the examination of one's role in a situation, setting and even institution, which requires a detachment from the situation. The journaling Boud argued for could be seen as a Benjaminian reproduction of an intimidating, unapproachable or emotionally overwhelming event. This is something that is clear when Boud (2001) wrote about "attending to feelings" (p.14). Writing about experiences allows students and teachers to keep hold of and examine chance occurrences of teaching and learning that provide new perspectives and meanings that may ultimately lead to

transformation (Tsuji, 2010). Not only does this transformative potential echoes the theories of Benjamin (Lewis, 2019; Tsuji, 2010), but the link between reflective writing and metacognition is also valid (O'Loughlin and Griffith, 2020; Ramadhanti et al, 2020). Reflective writing and collaborative metacognition can also take place through tools such as Knowledge Forum (Hong & Scardamalia, 2014; Scardamalia & Bereiter, 2008), demonstrating the potential for technology to be used to miniaturize learning experiences.

5. Discussion

Historically, education has aimed to reproduce society with an aura but still allows for opportunities to disrupt this reproduction (Snir, 2021). Nevertheless, as Snir (2021) also noted, "aura exists at school" (p.215). This can be extended to institutions of higher education such as colleges and universities. Therefore, it is crucial to examine the impact technological reproduction is having on the aura of higher education, its institutions and roles within. The ability to use digital technology to miniaturize vast quantities of information helps students and teachers alike examine more easily their learning, teaching, and the physical and digital settings in which they learn. This is evident in the development of the CoI (Garrison, 2022) and FOLC (van Oostveen et al, 2016) frameworks, both of which aim to increase student collaboration, critical reflection and self-efficacy, partly through collaborative metacognition. The FOLC's focus on moving away from teacher/teaching presence is a key distinction versus the CoI and is perhaps more indicative of digital technology's impact on the aura of education, particularly the tacit acceptance of its hierarchies.

Still, as Benjamin (2008) noted, aura is not something that will ever completely disappear. New objects, systems, technologies, methods can all develop auras as it "is the collective of perceivers that creates the aura of the aesthetic object by desiring to experience its uniqueness and singularity" (Johanssen, 2018, p.646). This may also mean that digital technology will not completely usurp the old forms of educational technology such as the school but rather they may coexist (Snir, 2021). This could become evident in the wake of pandemic pedagogies, with technology adoption becoming more common despite a yearning for in-class learning.

The idea that aura cannot completely disappear is a crucial guiding point for educators, particularly those immersed in online pedagogies. Frameworks such as the CoI and FOLC may point toward a dismantling of what Freire (2018) labelled the "banking system" of education, and the FOLC model aims to take Freire's logic further by reducing the role of the teacher. The impact of what digital technologies can facilitate in terms of emancipation from outdated, teacher-centred forms of education is promising. An important question to ask at this juncture is, what are the ideological implications of this? The physical classroom or lecture hall promote a focus on the teacher. In these environments, the teacher is often a conduit through which a society's ideology, its structures, and therefore aura can be reproduced. This provides critical theorists and pedagogues with a focal point, and the movement towards student-centred learning is a result of this. This means a critical focus must shift towards the new ideological terrain of self-reliance, self-efficacy, and student-centred pedagogy.

6. Conclusion

The act of "performing pandemic pedagogy" (Schwartzman, 2020) has left an indelible mark on feelings about education and approaches to teaching. Surveyed students overwhelmingly prefer in-class learning (Post-Pandemic Pedagogies, 2020), and levels of student attrition in online courses are a key concern (Lehman & Conceicao, 2014). However, this may originate from a lack of preparedness of teachers, faculties, and institutions to implement relevant and suitable pedagogies for online learning (Harouni, 2021; Post-Pandemic Pedagogies, 2020). McNeill, Gosper and Xu (2012) state, "universities increasingly acknowledge the value of skills such as problem solving, critical thinking and creativity, yet the curriculum needs to be designed to support and scaffold development of these skills." (2012, p. 283). This lagging behind of curriculum design is something that may also undermine the ability of educators to best utilize online spaces. Frameworks such as the CoI (Garrison, 2022) and FOLC (van Oostveen, 2016) models have provided practical approaches to online pedagogies. When utilized within these frameworks, digital technologies can facilitate a critical interrogation of learning through collaborative metacognition and reflective writing, which allow learners and teachers to miniaturize their learning and its context within broader structures. This critical interrogation is vital for educators and learners to evaluate and understand their roles within an environment, social structure or system. It is imperative that we analyze the impact of online learning on current best practices to understand how various incorporations of online learning and digital technology can be utilized. It is also important to analyze this unique moment's impact on teachers and learners and how we are all learning to collaborate and coexist in asynchronous, synchronous, hybrid, blended, distance, mulit-modal, remote and hyflex settings.

References

Angelino, L. & Natvig, D. (2009). A Conceptual Model for Engagement of the Online Learner, *Journal of Educators Online,* Vol. 6, No. 1, p. 1.

Akyol, Z., Garrison, D.R., 2011. Assessing metacognition in an online community of inquiry. The Internet and Higher Education 14, 183–190. https://doi.org/10.1016/j.iheduc.2011.01.005

Benjamin, W. (2008). *The work of art in the age of its technological reproducibility, and other writings on media.* Harvard University Press.

Boyer, N.R., Maher, P.A., Kirkman, S., 2006. Transformative Learning in Online Settings: The Use of Self-Direction, Metacognition, and Collaborative Learning. Journal of Transformative Education 4, 335–361. https://doi.org/10.1177/1541344606295318

Cochrane, T. (2012). Secrets of m-learning failures: confronting reality. *Research in Learning Technology*, ALT-C Conference Proceedings, http://dx.doi.org/10.3402/rlts2010.19186

Dabbagh, N. & Kitsantas, A. (2004). Supporting Self-Regulation in Student-Centered Web-based Learning Environments, *International Journal on E-Learning*, Vol. 3, No. 1, pp. 40–47.

Flavin, M. (2012). Disruptive technologies in higher education. *Research in Learning Technology*, ALT-C 2012 Conference Proceedings. http://dx.doi.org/10.3402/rlt.v2010.19184

Flavell, J., 1979. Metacognition and Cognitive Monitoring: A New Area of Cognitive-Developmental Inquiry. https://doi.org/10.1037/0003-066X.34.10.906

Freire, P. (2018). *Pedagogy of the oppressed.* Bloomsbury.

Garrison, R., 2022. Shared Metacognition in a Community of Inquiry. Online Learning 26. https://doi.org/10.24059/olj.v26i1.3023

Harouni, H., 2021. Unprepared humanities: A pedagogy (forced) online. *Journal of Philosophy of Education,* Vol. 55, pp. 633–648. https://doi.org/10.1111/1467-9752.12566

Hong, H.-Y., Scardamalia, M., 2014. Community knowledge assessment in a knowledge building environment. Computers & Education 71, 279–288. https://doi.org/10.1016/j.compedu.2013.09.009

Johannßen, D., 2018. *Miniaturization: Reading Benjamin in the Digital Age*. MLN 133, 637–653. https://doi.org/10.1353/mln.2018.0043

Kearney. M., Schuk, S., Burden, K. & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. *Research in Learning Technology*, Vol. 20, No. 14406. doi: 10.3402/rlt.v2010.14406

Kizilcec, R. & Halawa, S. (2015). Attrition and Achievement Gaps in Online Learning, Proceedings of the Second (2015) ACM Conference on Learning. pp. 57 – 66.

Lehman, R. & Conceição, S. (2014). *Concerns and Opportunities for Online Student Retention, In Motivating and Retaining Online Students: Research-Based Strategies That Work*, San Francisco: Wiley & Sons, 2014.

Lewis, T.E., 2019. The Art of Straying: Benjamin on Distraction and the Informal Education of the City. Educational Theory 69, 169–183. https://doi.org/10.1111/edth.12361

Lin, H. & Lee, G. (2006). Determinants of success for online communities: an empirical study. *Behavior and Information Technology*, Vol. 25, No. 6, pp. 479-488.

Littlejohn, A., Beetham, H. & McGill, L. (2012). Learning at the digital frontier: a review of digital literacies in theory and practice. *Journal of Computer Assisted Learning*, Vol. 28, 547-556. doi: 10.1111/j.1365-2729.2011.00474.x

Masschelein, J., Simons, M., 2013. *In Defence of the School: A Public Issue*. E-ducation, Culture & Society Publishers.

McNeill, M., Gosper, M. & Xu, J. (2012). Assessment choices to target higher order learning outcomes: the power of academic empowerment. *Research and Learning Technology*, Vol. 20, No. 17595 doi: 10.3402/rlt.v2010.17595

Negretti, R., 2012. Metacognition in Student Academic Writing: A Longitudinal Study of Metacognitive Awareness and Its Relation to Task Perception, Self-Regulation, and Evaluation of Performance. Written Communication 29, 142–179. https://doi.org/10.1177/0741088312438529

O'Loughlin, V.D., Griffith, L.M., 2020. Developing Student Metacognition through Reflective Writing in an Upper Level Undergraduate Anatomy Course. Anatomical Sciences Education 13, 680–693. https://doi.org/10.1002/ase.1945

Post-Pandemic Pedagogies. (2020). http://canadacommons.ca/artifacts/1420609/post-pandemic-pedagogies/2034660/

Ramadhanti, D., Ghazali, A.S., Hasanah, M., Harsiati, T., Yanda, D.P., 2020. The Use of Reflective Journal as a Tool for Monitoring of Metacognition Growth in Writing. International Journal of Emerging Technologies in Learning (iJET) 15, 162–187.

Redwine, T., Leggette, H., Prather, B., 2017. A Case Study of Using Metacognitive Reflections to Enhance Writing Skills and Strategies in an Agricultural Media Writing Course. Journal of Applied Communications 101. https://doi.org/10.4148/1051-0834.1014

Scardamalia, M., Bereiter, C., 2008. Pedagogical Biases in Educational Technologies. Educational Technology 48, 3–11.

Schwartzman, R., 2020. Performing pandemic pedagogy. *Communication Education*, Vol. 69, 502–517. https://doi.org/10.1080/03634523.2020.1804602

Snir, I., 2021. Walter Benjamin in the Age of Post-critical Pedagogy. *Studies in Philosophy and Education* 40, 201–217. https://doi.org/10.1007/s11217-020-09749-2

Teng, M.F., 2021. The effectiveness of incorporating metacognitive prompts in collaborative writing on academic English writing skills. Applied Cognitive Psychology 35, 659–673. https://doi.org/10.1002/acp.3789

Tsuji, A., 2010. Experience in the Very Moment of Writing: Reconsidering Walter Benjamin's Theory of Mimesis. Journal of Philosophy of Education 44, 125–136. https://doi.org/10.1111/j.1467-9752.2010.00747.x

van Oostveen, R., DiGiuseppe, M., Barber, W., Blayone, T. and Childs, E., 2016, June. New conceptions for digital technology sandboxes: Developing a Fully Online Learning Communities (FOLC) model. In *EdMedia+ Innovate Learning* (pp. 665-673). Association for the Advancement of Computing in Education (AACE).

Zimmerman, B.J., 2002. Becoming a self-regulated learner: an overview. Theory into Practice 41, 64–71.

Authentic Assessment in Higher Education: Applying a Habermasian Framework

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Abstract: The pursuit of authentic assessment has challenged educators to redesign and reformulate assessment and evaluation to better meet the needs of digital-era learners. Its primary goal has been to bring more accurate representations of "real world" situations and characteristics to education through assessment. However, these moves toward authentic assessment have too often limited notions of authenticity to an *external* real world, which itself is often limited to the world of work. This restricted view of authenticity in assessment risks neglecting key aspects of students' ontological and epistemological subjectivity, and their ever-changing, evolving and *authentic* notions of self. Authentic assessment requires a holistic approach that underscores the student as an individual within a society. This means we must strike a balance between social expectations and individual autonomy because authentic assessment that aims to replicate the world of work risks neglecting student agency, self-determination and the desire to achieve subjective authenticity. This paper's purpose is to critically interrogate authentic assessment and analyse theoretical frameworks upon which higher education can build and implement balanced and holistic approaches to authenticity in assessment. Resting on Jurgen Habermas' *Knowledge Constitutive Interests*, the authors argue for a more balanced approach to authentic assessment that incorporates human drives for objectified knowledge, communicative rationality, and emancipatory learning. After establishing the relevance of Habermas' theoretical framework to authentic assessment, this paper examines the value of self, peer and negotiated assessment and the potential of digital tools to aid these processes.

Keywords: authentic assessment, higher education, Habermas, adult education

1. Introduction

Adult and higher education have long focused on the goals of perspective transformation, lifelong learning and the development of identity (Knud, 2014; Mezirow, 1981; Mezirow, 2000). Central to these goals are the tasks of critical thinking, critical self-reflection, and collaboration. It is important to build assessments around these skills, but it is difficult to implement widespread and reliable criteria for them (Davis, 2013). However, if reliability is disproportionately emphasised over validity, testing and assessment become less valuable ends that dictate educational means (Boud et al., 1999; Davis, 2013, p.227; Madaus & O'Dwyer, 1999; Wiggins, 1989). This is particularly relevant to online learning, which often falls into top-down modes of content delivery (Tilak & Glassman, 2020) not conducive to the aforementioned emancipatory goals of adult and higher education. While modes of authentic assessment attempt to address these problems, there are often gaps in defining or determining what authenticity is. Drawing on Habermas' (1971) knowledge constitutive interests (KCIs), this paper argues that holistic, ontologically and epistemologically grounded approaches are required to develop authentic forms of assessment and help restore a balance between reliability and validity in assessment. It is through this theoretical lens that online tools for self, peer and negotiated assessment are evaluated.

2. Overview of assessment: Historically problematic

It is important to place authentic assessment in its historical context as, in part, a reaction to the shortcomings of assessment in the modern period. Modern period assessment (from 1900 to the 1980s) was characterised by efficient, cost-effective means of testing and examination that reliably reproduce results, a common example being the multiple-choice test (Madaus & O'Dwyer, 1999, p.693). Wiggins (1989, p.703) emphasised several key problems with modes of assessment geared toward efficiency, objectivity and reliability. He argued that tests are not designed in students' interests as they are geared too much toward widespread distribution, whose necessary focus then is on reliability, which is to the detriment of the education process itself. This detrimental effect on the practice of education is referred to as a "backwash" (Boud et al., 1999, p.418; Davis, 2013, p.227; Madaus & O'Dwyer, 1999, p.689), where an overemphasis on a particular approach to testing or assessment too strongly influences how a curriculum, course or class is designed or implemented, and even how a teacher behaves. This is where the tension between reliability and validity in test and assessment design is most visible (Davis, 2013; Wiggins, 1989), and where the former overrides the latter. Wiggins (1989) argued that this stems from "political, structural, and economic" circumstances such as time and financial constraints (p.704). To counter this, he argued for a student-centred approach to assessment that prioritises authenticity.

3. Defining authentic assessment

Wiggins (1989) outlined his concept of authentic assessment as both replicating "the challenges and standards of performance that typically face writers" and as "responsive to individual students and school contexts" (p.704). This, he claimed, "is most accurate and equitable when it entails human judgments and dialogue" (p.704). He goes on to describe four key elements of authentic assessment: structure and logistics, intellectual design features, standards of grading and scoring, and fairness and equity (Wiggins, 1989, p.711). These elements involve a balance between reliability and validity, real audiences, multiple judges, complex assessment criteria, real-life context, represented social and cultural standards, and an emphasis on holistic, open-ended assessments and tasks.

4. Theoretical framework: A gap in authentic assessment

While the emphasis on authentic assessment that emerged in the late 1980s signals a shift away from an overreliance on reliable and repeatable methods of assessment, theoretical issues with authentic assessment remain. As defined and outlined by Wiggins (1989; 1990), authentic assessment draws attention to and addresses problems with tests that over-prioritize reliability and objectivity, yet this still fails to address deeper interests of students. These interests can be revealed through ontological and epistemological analyses of individuals as social and critical beings.

Vu and Dall'Alba (2014, p.779) emphasised the gap between authentic assessment and ontology, stating that in requiring a closeness to real-life contexts or tasks, authentic assessment forgoes focusing on a student's sense of self. This sense of self is derived from Heidegger's concept of being, which concerns authenticity and inauthenticity. Authenticity involves individuals becoming more directly aware and responsible for themselves, whereas inauthenticity involves the uncritical replication of group or social behaviour (Vu & Dall'Alba, 2014, p.781). A recalibration of the ontology of authentic assessment is thus required, and Vu and Dall'Alba's (2014) argument is that assessment should help students achieve authenticity by enabling critical self-reflection and critical reflection on their environment, perceptions, and preconceptions. Ultimately, students must be aware of how to replicate social behaviour, but they must also be able to respond to it critically. Arguably, neither the modern-era forms of assessment (e.g. multiple choice tests) nor Wiggins' authentic assessment adequately facilitates this critical reflection.

Vu and Dall'Alba (2014) do not offer specific examples of what a Heideggerian approach to authentic assessment would entail, instead opting to provide a theoretical critique, which itself is problematic. McArthur (2022) argued that viewing authenticity through Heidegger focuses too much on the individual, thus neglecting the importance of the relationship between the individual and society. Instead, she has offered a critical stance that has as its central notion the inter-relationship between society and individual subjects as based on both individual autonomy and cooperation. This realignment of philosophical grounding brings into focus the importance of the individual in society and argues for three central tenets (McArthur, 2022, p.8-11):

- 1. Moving FROM real world/world of work TO society
- 2. FROM task performance TO why we value the task
- 3. FROM the status-quo of real-world/world of work TO transforming society

These points signify a critical engagement with transformative ends that aim to satisfy the drive towards individual autonomy and social cooperation, objectives a Heideggerian approach cannot achieve. Nevertheless, both a Heideggerian and critical approach to authenticity can help educators realign perceptions of, and move toward deeper notions of, authenticity.

5. Habermas' knowledge constitutive interests

Vu and Dall'Alba's (2014) ontological conceptualization of authentic assessment considers the importance of students' sense of being, and McArthur's (2022) theoretical critique injects a vital social component. Considering both publications' emphases on individual autonomy, and the latter's incorporation of engagement in social transformation, pertinent theoretical parallels are evident in Habermas' (1971) knowledge constitutive interests (KCIs). Further to this, McArthur's criticism of Heidegger's notion of authenticity is derived from the very critical theory upon which Habermas developed his theory of KCIs. It is through Habermas' theoretical framework that we can start to understand how to develop authentic assessment further and assess appropriate tasks to help students achieve autonomy in and with their societies.

Within the context of higher education, the aforementioned overemphasis on reliability and reproducibility with its resulting "backwash" is critically problematic and arguably a result of narrow definitions of authenticity and authentic assessment. This is particularly so considering Habermas' (1971) KCIs: technical interests, communicative interests, and emancipatory interests. Interest, for Habermas (1971), refers to "the basic orientations rooted in specific fundamental conditions of the possible reproduction and self-constitution of the human species, namely for work and interaction" (p.196). Roderick (1985) elucidates these "knowledge-guiding" constitutive interests as innate, stating Habermas' assertion that their conceptual basis arises from humans being "tool-making and language-using animals" (p.52). Therefore, as Roderick (1985) describes, these knowledge interests are borne out of the necessity to control our natural surroundings (technical interests) and to communicate through language or symbols (communicative interests). However, for humans to truly understand technical and communicative interests, a third interest that comes from the ability to act rationally is needed. This is the emancipatory knowledge interest, which involves self-reflection, self-determination, and the "creation of knowledge which furthers autonomy and responsibility" (Roderick, 1985, p.52). Each of these interests is essential to human social existence, and therefore ought to be represented in education (Boud & Brew, 1995; Denton, 2011; Hammond, 2015; Kruszelnicki, 2020). This interest has parallels in Freire's (2018) critical pedagogy, whose focus is on a democratic form of education that addresses social inequalities (Vassalo, 2013), and in Mezirow's (1981; 2000) transformative learning theory.

While each of these knowledge interests is vital and ought to be represented in higher education (Hammond, 2015; Kruszelnicki, 2020), it is the emancipatory interest that most directly concerns the authenticity of being. The emancipatory interest directly addresses the innate need to critically reflect on one's thinking, circumstances and environment, and it involves a focus on adult independence and responsibility, or M**ü**ndigkeit (maturity) (Habermas, 1971, p.197-198).

6. Making assessment more authentic

An overemphasis on reliability and reproducibility imposes instrumental rationality on education and assessment that hinders emancipatory knowledge interests through its "backwash" effect. This reduces the focus on critical self-reflection and critical engagement with one's surroundings; necessary parts of authentic being, learning, and therefore assessment. Although there is consistent institutional and economic pressure that pushes more generalizable assessment and testing onto students and faculty (Madaus & O'Dwyer, 1999; Wiggins, 1989), several approaches to assessment have demonstrated some efficacy in achieving more balanced and therefore authentic modes of assessment.

6.1 Self-Assessment

Boud and Brew (1995) argued for a Habermasian approach to assessment and emphasised that self-assessment can provide opportunities for students to satisfy each of Habermas' knowledge interests. For Boud and Brew, technical interests are evident when students strive to exercise objective control of grading criteria, which they use to measure and develop responses, while communicative interests are seen in the discussion of assessment criteria and feedback. Emancipatory interests are evident when students step back and critically reflect on their learning in response to assessment feedback and grades. Thus, self-assessment has the potential to satisfy each KCI.

6.2 Peer assessment

A further possible extension of Boud and Brew's (1995) typology for self-assessment can be seen in peer assessment (Gielen et al., 2011), which bears many similarities to self-assessment (Panadero et al., 2016). Peer assessment is a useful tool for engagement in the learning process, which helps moderate instrumental ends of assessment while giving students the chance to own and interrogate the learning process, thus encouraging greater learner responsibility (Gielen et al., 2011, p. 731). Utilising peer assessment also encourages interactions that lead to co-regulation and collaborative learning (Panadero et al., 2016).

While peer assessment has demonstrated efficacy in improving critical self-awareness (Panadero et al., 2016), there are challenges in implementing it. Boud et al. (1999, p.421) stated that formal peer assessment can often be counterproductive to student cooperation, particularly in competitive environments where students are ranked by grade, or are summative, with students acting as replacement assessors whose chief goal is to expedite grading (Boud, 2000, p.157). These tensions are echoed by Zhou et al. (2021), who emphasise the

social-affective impacts of peer assessment, stating that students often believe respect is not reciprocal. Price et al. (2011) highlight concerns with short-termism in peer assessment and feedback being viewed as a product rather than part of an ongoing dialogue constituting a developing relationship. Teachers and students alike see self and peer assessment less as promoting critical self-reflection or feedback – key goals for self-regulated and lifelong learning – and more as a way of controlling and maintaining student involvement (Willey & Gardner, 2010).

Boud et al. (1999), however, propose several potential solutions, including a combination of peer feedback and self-assessment, which would have one key purpose: to help enable critical cooperation by reducing implicit or explicit competition. Emphasising feedback over assessment, Zhu and Carless (2018) highlighted its increasing relevance and importance to academic writing in higher education. Building on research that has argued for the efficacy of peer feedback as a tool for boosting inner feedback processes (Nicol et al., 2014), Zhu and Carless' (2018) qualitative study involving observation of feedback within classes, the collection of reflective journals, and interviews with individuals and focus groups found that dialogue is beneficial to both the receiver and provider of feedback. However, it is the provider who gains more from the process as it forces them to spend more time critically reflecting on assessment criteria, thus enabling deeper learning. Another key element of feedback exchange for Zhu and Carless (2018) was that oral discussions of feedback engaged students in clarification and negotiation processes that were less likely to happen through written communication.

For Habermas (1971, p.199-198), the emancipatory human interest involves a drive toward autonomy and responsibility for oneself. Yuan and Kim (2018) identified supporting the desire for autonomy as a key area of concern in peer assessment in online spaces. Using Su and Reeve's (2011) autonomy-supportive strategies - providing choices, demonstrating rationales for peer assessment, utilising non-controlling language, and recognizing students' negative feelings - they developed a peer assessment website for students to use. For the experimental group, the website explained the importance of peer assessment, provided a variety of sources explaining different approaches to peer assessment, afforded students opportunities via prompts to express frustrations with the peer assessment process, and withdrew any instructions that commanded students to act. Yuan and Kim (2018) did not find a significant difference in engagement or feelings of autonomy between the experimental and control group. This, they posited, was partly due to the unintended autonomy granted to the control group. Despite this, the focus on autonomy support can be viewed as a central element of encouraging peer assessment, and the use of technology as a peer assessment tool offers an alternative to face-to-face interactions.

Both communicative and emancipatory knowledge interests are evident in the development of student knowledge of writing through peer feedback processes using tools such as peerScholar (Paré & Joordens, 2008). The peerScholar system is a web-based tool for peer assessment, allowing students to engage in, explore, expand on and assess work without being overly reliant on an expert (Joordens et al., 2009, p.12). PeerScholar guides students through three stages: the reading and writing phase, the marking phase, and the results and feedback phase (Paré & Joordens, 2008). Paré and Joordens (2008) found that the mean grades given by students through peerScholar differed very slightly from those given by expert markers (in this case, graduate students), which indicates an encouraging level of fairness and consistency also seen in traditional classroom-based peer assessment.

Another tool that enables peer to peer assessment and feedback is Kritik. Kritik aims to help students achieve metacognition, self-reflection, and lifelong learning through direct peer-to-peer communication for feedback and assessment (*How Peer Assessment Develops the Higher-Order Thinking Skills Students Need Today*, no date). Although relatively new to online education, and therefore in need of further scrutiny, Kritik's own analysis purports its ability to provide actionable, valid, timely feedback with the opportunity to engage in dialogue with an assessor. Each of these aspects is difficult to achieve through unidirectional, teacher-disseminated feedback.

6.3 Negotiated assessment

In relation to the dialogic merits of peer feedback, negotiated assessment can also be used to minimise the tension inherent in peer assessment. Negotiated assessment involves the discussion of, and agreement on, assessment processes with regards to learning goals and outcomes (Boud et al., 1999). A benefit of negotiated assessment is that it provides an opportunity for all parties, peers and teachers, to discuss assessment. Zhu and Carless (2018) emphasise the importance of teacher scaffolding for peer feedback, and negotiated assessment

may also provide opportunities for teachers to clarify key concepts of evaluation, ensure the inclusion of non-negotiable assessment criteria, and help maintain consistency across different groups (Boud et al., 1999).

Beyond the practical benefits of negotiated assessment, Gosling (2000) argues that negotiated assessment has the potential to help students overcome the pathologies of distorted communication in higher education classrooms. Using Habermas' theories of communicative action and KCIs as frameworks, Gosling's (2000) action research implemented negotiated assessment in two graduate-level courses. While students initially found the process ambiguous and unnerving, they ultimately saw the benefit of engaging in negotiated assessment, emphasising the satisfying and rewarding nature of taking control of one's learning. Supporting the framework proposed for negotiated assessment by Gosling (2000), Morrison (2015) extends further the importance of KCIs and adopts Habermas' Theory of Communicative Action as a means to reduce domineering technicism and bureaucratization. Communicative action emphasises discursive action, critical interrogation of ideology, and the scrutinization of educational practices such as assessment and evaluation, all of which are possible in self, peer and negotiated assessment.

7. Discussion

Often, critical pedagogy and education theories offer an almost diametric opposition to prevailing neoliberal economic ideologies. However, a theoretical approach such as Habermas' (1971) KCIs offers a more pragmatic balance for adult education (Hammond, 2015; Kruszelnicki, 2020) and therefore notions of authentic assessment. This means instrumental learning can take place alongside communicative and emancipatory learning. These should all be nurtured in adult education, with institutions, curricula, and teachers incorporating a balance of tasks and assessments that, in their design and implementation, involve consideration of each interest. However, assessment has often neglected communicative and emancipatory knowledge interests. It is therefore important to develop holistic approaches to assessment that incorporate these knowledge interests that are central to the goals of self-realisation and social engagement adult education purports to facilitate. The approaches considered here – self, peer and negotiated assessment – have the theoretical potential to facilitate a balance between the three knowledge constitutive interests (Boud & Brew, 1995). This potential has been supported by Zhu and Carless' (2018) study, which emphasises the positive role dialogue can play in supporting deeper learning and critical self-awareness, both of which are key aspects of communicative and emancipatory learning. Gosling's (2000) study on negotiated assessment also highlights the emancipatory learning benefits of open dialogue in educational settings.

Self-assessment and peer assessment can both be justified through a Habermasian typology (Boud & Brew, 1995; Gielen et al., 2011), and have both demonstrated efficacy in promoting self-regulated learning and self-efficacy among students (Panadero et al., 2016; 2017). Further to this, peer assessment can boost self and co-regulation qualities (Panadero et al., 2016). Educational frameworks for online communities require various digital tools. The importance of discussion forum use and design is also highlighted by Garrison (2022) and Scardamalia and Bereiter (2008). However, there are concerns about the tendency for LMSs to act as an information repository rather than an environment for critical learning (Boyd, 2016), which echoes Freire's (2018, p.72) stance against the banking concept of education, and Tilak and Glassman's (2020) concerns of a top-down system of information distribution. A more practical tool for self, peer and negotiated assessment is Knowledge Forum (WebKF) (Scardamalia & Bereiter, 2008). Unlike traditional discussion forums utilized by many Learning Management Systems, WebKF appears as a manipulable mindmap in its design, which helps support collaborative learning as students can design the layouts of their discussions and interactions (Hong & Scardamalia, 2014). This gives students the chance to take control of their collaborative learning in a much more tangible way.

Several forms of educational technology have demonstrated efficacy in improving key aspects of critical learning such as autonomy, self-reliance, self-efficacy, self-regulation, co-regulation and collaboration. The use of autonomy-supportive strategies (Su & Reeve, 2011; Yuan & Kim, 2018), scaffolding in web tools (Paré & Joordans, 2009; Scardamalia & Bereiter, 2008) and peer-to-peer feedback and assessment tools such as Kritik (*How Peer Assessment Develops the Higher-Order Thinking Skills Students Need Today*, no date) offer realistic alternatives to top-down information distribution. While the dialogic and collaborative approaches of self, peer and negotiated assessment demonstrate theoretical and practical promise, there are other key considerations to take into account. Facilitating student cooperation is complex, and while some social-affective issues (Zhou et al., 2021) and tensions of high-stakes assessment have been considered (Boud et al., 1999), this paper is

chiefly concerned with supporting a theoretical framework for authenticity and authentic assessment. Organisational support, student buy-in and teacher reluctance are considerations for future research on implementing authentic assessment.

A common thread in self and peer assessment is the emphasis on student self-regulation and self-efficacy. These are all common goals in student-centred learning which, while preferable to teacher-centred learning, offers up new challenges for critical theories of education.

Emphases on self-regulated learning often point towards the notion that students should become independent, autonomous, mature lifelong learners. However, criticisms of self-regulated learning warn of ethical complexities in pushing students to self-regulate in an academic setting (Diaz-Diaz, 2022; Vassalo, 2013; 2015). The risks Diaz-Diaz (2022) and Vassalo (2013; 2015) warn of are inherent in student-centred learning that is grounded in a neoliberal economic framework. These concerns have been echoed in relation to educational institutions' adoption and adaptation to digital technologies under neoliberal economic imperatives both pre-covid pandemic (Boyd; 2016, Kruszelnicki, 2020; Regmi, 2017) and since the covid pandemic began (Schwartzman, 2020). These criticisms and concerns have parallels with authentic assessment, which too often blinkers educators' perspectives, incorporating an atomizing and overly-individualistic emphasis on student needs (McArthur, 2022). Incorporating a critical approach a la Habermas, which is oriented towards autonomy both in and with communities, can help provide a broader notion of authenticity in education and assessment

8. Conclusion

The initial conception of authentic assessment addressed the imbalance in objectively applied, repeatable mass testing and assessment and returned assessment's focus to student needs. However, notions of authenticity are too often restricted to ideas of the "real world" as the world of work. As educators begin to incorporate more digital tools, and online learning continues to grow, it is imperative that education, curriculum, and assessment design do not continue to adopt narrow conceptions of authenticity. Developing assessment necessitates the consideration of more complex views of authenticity, including an analysis of ontological (Vu & Dall'Alba, 2014) and epistemological (Boud & Brew, 1995; Habermas, 1971) concerns. Habermas' (1971) knowledge constitutive interests offer a pragmatic lens through which practitioners of higher education can assess methods of assessment design and the potential of digital tools to enable more authentic forms of assessment.

References

Boud, D. (2000). Sustainable Assessment: Rethinking assessment for the learning society. *Studies in Continuing Education*, Vol. 22, No. 2, pp.151–167. https://doi.org/10.1080/713695728

Boud, D., & Brew, A. (1995). *Developing a typology for learner self-assessment practices*. Vol.18, pp. 130–135.

Boud, D., Cohen, R., & Sampson, J. (1999). Peer learning and assessment. *Assessment & Evaluation in Higher Education*, Vol. 24, No. 4, pp. 413–426. https://doi.org/10.1080/0260293990240405

Boyd, D. (2016). What Would Paulo Freire Think of Blackboard™: Critical Pedagogy in an Age of Online Learning. *International Journal of Critical Pedagogy*, Vol. 7, No.1, pp. 165–186.

Davis, A. (2013). How far can we aspire to consistency when assessing learning? *Ethics and Education*, Vol. 8, No. 3, pp. 217–228. https://doi.org/10.1080/17449642.2013.876788

Denton, D. (2011). Reflection and Learning: Characteristics, obstacles, and implications. *Educational Philosophy and Theory*. Retrieved 19 March 2022, from https://onlinelibrary-wiley-com.uproxy.library.dc-uoit.ca/doi/full/10.1111/j.1469-5812.2009.00600.x

Diaz-Diaz, C. (2022). Against the self-regulated child: Early childhood pedagogies in neoliberal times. *Global Studies of Childhood*, 20436106221117564. https://doi.org/10.1177/20436106221117563

Freire, P. (2018). *Pedagogy of the oppressed.* Bloomsbury.

Garrison, R., 2022. Shared Metacognition in a Community of Inquiry. Online Learning 26. https://doi.org/10.24059/olj.v26i1.3023

Gielen, S., Dochy, F., Onghena, P., Struyven, K., & Smeets, S. (2011). Goals of peer assessment and their associated quality concepts. *Studies in Higher Education*, Vol. 36, No. 6, pp. 719–735. https://doi.org/10.1080/03075071003759037

Gosling, D. (2000). Using Habermas to evaluate two approaches to negotiated assessment. *Assessment & Evaluation in Higher Education*, Vol. 25, No. 3, pp. 293–304. https://doi.org/10.1080/02602930050135158

Habermas, J. (1971). *Knowledge and human interests.* Beacon.

Hammond, M. (2015). A Habermasian perspective on joint meaning making online: What does it offer and what are the difficulties? International Journal of Computer- Supported Collaborative Learning, Vol. 10, No. 3, pp. 223–237. https://doi.org/10.1007/s11412-015-9215-1

Hong, H.-Y., Scardamalia, M., 2014. Community knowledge assessment in a knowledge building environment. Computers & Education 71, 279–288. https://doi.org/10.1016/j.compedu.2013.09.009

How Peer Assessment Develops the Higher-Order Thinking Skills Students Need Today (no date). Available at: https://www.kritik.io/webinars/how-peer-assessment-develops-the-higher-order-thinking-skills-students-need-today (Accessed: 8 October 2022).

Joordens, S., Desa, S., & Paré, D. (2009). The pedagogical anatomy of peer-assessment: Dissecting a peerScholar assignment. *Journal of Systemics, Cybernetics and Informatics*, Vol. 7, No. 5, pp. 11–15.

Knud, I. (2014). Transformative learning and identity. Routledge. http://uproxy.library.dc-uoit.ca/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=638864&scope=site

Kruszelnicki, W. (2020). Self-directedness and the question of autonomy: From counterfeit education to critical and transformative adult learning. *Studies in Philosophy and Education*, Vol. 39, No. 2, pp. 187–203. https://doi.org/10.1007/s11217-019-09697-6

McArthur, J. (2022). Rethinking authentic assessment: Work, well-being, and society. *Higher Education*. https://doi.org/10.1007/s10734-022-00822-y

Madaus, G. F., & O'Dwyer, L. M. (1999). A short history of performance assessment: Lessons learned. *Phi Delta Kappan*, Vol. 80, No. 9, pp. 688–689.

Mezirow, J. (1981). A critical theory of adult learning and education. *Adult Education*, Vol. 32, No. 1, pp. 3–24. https://doi.org/10.1177/074171368103200101

Mezirow, J. (2000). Learning to think like an adult: Core concepts of transformation theory. In J. Mezirow, & Associates (Eds.), *Learning as Transformation*: *Critical Perspectives on a theory in progress* (pp. 3-33). Jossey-Bass. 13

Morrison, K. (2015). The Colonization of Lifeworlds of Education by Work: Restoration and Recoupling of Lifeworld and System in the Inner Self. *Horyzonty Wychowania*, Vol. 14, No. 30, pp. 47–72.

Nicol, D., Thomson, A., & Breslin, C. (2014). Rethinking feedback practices in higher education: A peer review perspective. *Assessment & Evaluation in Higher Education*, Vol. 39, No. 1, pp. 102–122. https://doi.org/10.1080/02602938.2013.795518

Panadero, E., Jonsson, A., & Strijbos, J.-W. (2016). Scaffolding Self-Regulated Learning Through Self-Assessment and Peer Assessment: Guidelines for Classroom Implementation. In D. Laveault & L. Allal (Eds.), *Assessment for Learning: Meeting the Challenge of Implementation* (pp. 311–326). Springer International Publishing. https://doi.org/10.1007/978-3-319-39211-0_18

Panadero, E., Jonsson, A., & Botella, J. (2017). Effects of self-assessment on self-regulated learning and self-efficacy: Four meta-analyses. *Educational Research Review*, Vol. 22, 74–98. https://doi.org/10.1016/j.edurev.2017.08.004

Paré, D. e., & Joordens, S. (2008). Peering into large lectures: Examining peer and expert mark agreement using peerScholar, an online peer assessment tool. *Journal of Computer Assisted Learning*, Vol. 24, No. 6, pp. 526–540. https://doi.org/10.1111/j.1365-2729.2008.00290.x

Price, M., Handley, K., & Millar, J. (2011). Feedback: Focusing attention on engagement. *Studies in Higher Education*, Vol. 36, No. 8, pp. 879–896. https://doi.org/10.1080/03075079.2010.483513

Regmi, K. D. (2017). Habermas, lifeworld and rationality: Towards a comprehensive model of lifelong learning. *International Journal of Lifelong Education*, Vol. 36, No. 6, pp. 679–695. https://doi.org/10.1080/02601370.2017.1377776

Roderick, R. (1985). Habermas on rationality. *Man and World*, Vol. 18, No. 2,pp. 203–218. https://doi.org/10.1007/BF01248615

Scardamalia, M., Bereiter, C., 2008. Pedagogical Biases in Educational Technologies. Educational Technology 48, 3–11.

Tilak, S., & Glassman, M. (2020). Alternative lifeworlds on the Internet: Habermas and democratic distance education. *Distance Education*, Vol. 41, No. 3, pp. 326–344. https://doi.org/10.1080/01587919.2020.1763782

Vassallo, S. (2013). Critical Pedagogy and Neoliberalism: Concerns with Teaching Self-Regulated Learning. *Studies in Philosophy and Education*, Vol. 32, No. 6, pp. 563–580. https://doi.org/10.1007/s11217-012-9337-0

Vassallo, S. (2015). A critical consideration of the alignment between the discourse of self-regulated learning and neoliberalism. *Emotional and Behavioural Difficulties*, Vol. 20, No. 1, pp. 82–97. https://doi.org/10.1080/13632752.2014.947102

Vu, T. T., & Dall'Alba, G. (2014). Authentic assessment for student learning: An ontological conceptualisation. *Educational Philosophy and Theory*, Vol. 46, No. 7, pp. 778–791. https://doi.org/10.1080/00131857.2013.795110

Wiggins, G. (1989). A true test: Toward more authentic and equitable assessment. *Phi Delta Kappan*, Vol. 70, No. 9, pp. 703–714.

Wiggins, G. (1990). The case for authentic assessment. *Practical Assessment, Research, and Evaluation*, Vol. 2, No.1, https://doi.org/10.7275/ffb1-mm19

Willey, K., & Gardner, A. (2010). Investigating the capacity of self and peer assessment activities to engage students and promote learning. *European Journal of Engineering Education*, Vol. 35, No. 4, pp. 429–443. https://doi.org/10.1080/03043797.2010.490577

Yuan, J., & Kim, C. (2018). The effects of autonomy support on student engagement in peer assessment. *Educational Technology Research and Development*, Vol. 66, No.1, pp. 25–52. https://doi.org/10.1007/s11423-017-9538-x

Zhou, J., Dawson, P., Tai, J. H.-M., & Bearman, M. (2021). How conceptualising respect can inform feedback pedagogies. *Assessment & Evaluation in Higher Education*, Vol. 46, No. 1, pp. 68–79. https://doi.org/10.1080/02602938.2020.1733490

Zhu, Q., & Carless, D. (2018). Dialogue within peer feedback processes: Clarification and negotiation of meaning. *Higher Education Research & Development*, Vol. 37, No. 4, pp. 883–897. https://doi.org/10.1080/07294360.2018.1446417

The Impact of Emergency Online Learning and Teaching on Mature Part-Time Students

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Abstract: During the COVID-19 pandemic, most institutions of higher education in South Africa, following an international trend, embarked on a mission to save the academic project by resorting to emergency online teaching and learning (EOLTL). The pandemic resulted in mature, part-time, working students being even further marginalised by removing them from university life and the accompanying support services geared to facilitate social, academic and mental well-being. We assumed that the cohort of mature, part-time students (MPTS) would encounter technological and personal challenges that could limit their academic progress. Against this backdrop, the dual aim of this study explored the impact of EOLTL on MPTS during the COVID-19 pandemic; and the redesign or readjustment of the curriculum to accommodate and support this cohort of students. A previous, pre-pandemic study, revealed that this group of students experienced significant challenges with balancing work-and-home life in addition to the stress of studying part-time. Subsequently, a questionnaire was designed and piloted with a group of senior students from this cohort to explore the impact of EOLTL. As an ongoing study, this research will report on the findings from the pilot study and compare them to the results of the data obtained from the pre-pandemic study. A significant finding of the study indicated that the majority of the students from this cohort coped well with EOLTL and indicated a preference for a more hybrid approach for the future and the remainder of their studies. These findings now challenge universities to find ways to adapt, capitalise on and apply the lessons learnt from the COVID-19 pandemic to benefit MPTS. Based on lessons learnt and experiences during the pandemic, this research has the potential to provide insight into how higher education institutions could improve the provision of support, as well as the learning and teaching experiences of this unique student cohort of mature employed students studying part-time (and others), to ensure retention and academic success.

Keywords: COVID-19, engineering education, emergency teaching and learning, marginalised mature part-time working students

1. Introduction

Framed by lifelong learning, upgrading workforce skills, improving education access, transformation and competitiveness in South Africa, higher education qualifications should be available to those who qualify and wish to further their studies. Higher education access includes education opportunities for those beyond "traditional" student profiles largely comprised of 18 to 19-year-old students who recently matriculated (McVitty & Morris, 2012). With widening access, student profiles now include mature part-time students (MPTS) who are mostly in full-time employment.

Higher education represents life-changing opportunities for MPTS, but can also pose significant challenges as they balance academic studies, full-time employment and financial responsibilities, which, in turn, can influence their academic success (McVitty & Morris, 2012; Parker, Summerfeldt, Hogan & Majeskie, 2004). For the benefit of the individual student and the social and economic contribution that a successful MPTS can make, it is imperative for higher education institutions to support these students to ensure their retention and success.

This study was conducted at a comprehensive university in South Africa. The respondents in this study were enrolled for a 3-year diploma (offered over a four-year period) which was offered by a department in the School of Engineering. Previously, MPTS had reported balancing work, studies and family as their biggest challenge toward the successful completion of their diploma. These students were enrolled in a diploma programme that had been offered on a part-time basis for approximately 30 years at a South African university and the programme consisted of semester modules. Since this academic programme is designed for individuals who are employed, lectures are presented as three-hour contact sessions, after hours. The programme is staffed by full-time academic staff and subcontracted experienced, part-time lecturers with relevant work experience (Lourens, Connelly & Plaatjes, 2018).

The average age of this student group was 31.5 years, drawn from a wide spectrum of occupations ranging from machine operators to supervisors and middle management, mostly in the manufacturing industry. In most cases this cohort, having transitioned from high school directly into employment in the industry, found the student role to be a daunting experience since they had not had any recent exposure to the pressures associated with studying, writing tests and examinations at a higher education institution. Due to their full-time employment, compounded by shift-work, it was not always possible for these students to utilise university support and attend developmental workshops that were offered to full-time students during normal university hours. A further challenge facing this group was fatigue as they often worked a full day in factory-related positions where they were physically active. Such work environments could make concentrating for three hours in an evening class challenging (Lourens et al., 2018).

When the country went into lockdown in 2020 due to the COVID-19 pandemic major challenges were created for all citizens, sectors and industries. The challenge for higher education institutions (HEIs) was the successful completion of the academic project when face-to-face classes were no longer possible. Furthermore, there seemed no end to the pandemic and there was great uncertainty regarding a return to the classroom and "life pre-COVID". Fortunately, the University was quick to respond to the situation and all academics, support staff and students were provided with online resources, training and information. Currently, in 2022, all university students have not yet returned to the classroom and a model of hybrid teaching and learning is being followed until all students and staff are required to return to campus full time.

From the start of the pandemic, most students were quick to respond and adapt to either online or hybrid teaching and learning and some, especially the MPTS, expressed a desire for the status quo, or "new normal" to remain in place. This is contrary to indications from previous studies and student feedback where it was reported that two of the greatest challenges experienced by this student group was balancing home and work life and being a student. In fact, these challenges were expected to be accentuated by the online landscape.

Accordingly, this research aims to foster a deeper understanding of this student group, which had to date been far less explored in comparison to the younger full-time students, and in particular, with reference to their experiences of a new online and hybrid form of teaching and learning. In addition, this research explored the developmental needs of this cohort and provided suggestions for their support. To conclude, the paper discussed the findings and makes recommendations regarding the importance of student retention and success.

Based on experiences and lessons learnt during the pandemic, this research provides potential insights into how HEIs could improve support and the learning and teaching experiences of a unique student cohort, namely the mature, part-time, working students (and others) to ensure retention and academic success. An overview of the challenges faced by marginalised mature part-time students follows this introduction, followed by the research methodology, results and discussion, and thereafter finally the conclusion is presented.

2. Challenges faced by marginalised mature part-time students

Higher education provides a range of opportunities with inherent challenges for students of all ages. Full-time, first-year university students often face a variety of stressors such as living away from home, becoming independent adults, building new relationships and learning appropriate study habits for adjustment to a new academic environment. These factors can greatly affect student retention and academic success (Parker et al., 2004). Often, many of these challenges are compounded for MPTS who have to cope with studying in addition to managing full-time employment and family life successfully. Mature students also hold the opportunity to study in high regard and are more likely to reflect upon their learning and make judgements about what they regard as valuable (Taylor, Walton, Mellor & McCarter, n.d.). In addition, mature students often enter university with something to prove and they make use of their education to create a better future for themselves.

Taylor et al., (n.d.) proposed that practitioners of higher education have generally found it rewarding to teach mature students. These practitioners attribute this to the mature students being able to appreciate the importance of active learning and their willingness to often question what they were being taught. The practitioners also recognised that these students were being equipped with skills that they could transfer to their workplaces and communities. Not surprisingly mature students were often apprehensive about entering higher education because they doubted their abilities to succeed in the face of academic demands. Inevitably doubt

and fear often diminished when they recognised that they were able to participate effectively and realised that their experiences in higher education could transform their thinking and future.

Schuller (2002) confirmed the importance of addressing the challenges faced by this group of students. Schuller (2002) argues that there is a need to recognise that higher education is important to adults over the age of 30 and that opportunities must be created for them to either enter or re-enter the formal education system. Schuller (2002) cites the following four reasons to support his argument:

- The likelihood is greater that more mature students have never had the opportunity to enter higher education or formal studies as younger people currently do. This makes a strong case for the entry of more mature students to higher education on the grounds of intergenerational equity.
- Individuals aged 30 and older often need access to formal education and qualifications to progress in the labour market.
- Higher education often provides the means to involve individuals in important social networks.
- There is a need to change thinking about the capabilities of more mature students and mixing the generations in the university should be part of that process.

McVitty and Morris (2012) suggested that MPTS found the first few days at university particularly daunting, as they had to understand the campus layout and cope with the huge chunks of information shared in addition to their fears of coping with the new academic environment. They also found those mature students who returned to education after a long hiatus tended to take longer to adjust to learning and mastering the requirements of an unfamiliar academic culture. Academic support workshops have been experienced as positive and "life-saving" for many mature students. Additionally, students who have been offered support were less likely to leave. Bowl found that an obstacle to overcome within the university was "learning the rules of academia" (2010:156) in addition to time management, reading and writing assignments.

2.1 Feedback from mature, part-time working students

Prior pre-pandemic feedback from MPTS (Lourens, et al., 2018) highlighted significant challenges that the students perceived as having an impact on their academic success. The greatest perceived challenge listed by this cohort was balancing work and home life. A close contender was stress related to studying part-time as evidenced by one student who stated that, "*working shifts at work which leaves me tired and unable to study",* and another who mentioned the *"availability of time between work and having a rather young family*".

Several students listed external issues such as the possibility of being "*hospitalised*", or "*if work should not pay for my studies*" as possible challenges whilst another indicated that "*I will not let any factor get in my way of completing my studies*". These responses indicated the high value attached to obtaining a formal qualification and the potential resultant benefits. It was, therefore, important to provide support for this cohort of students who appeared to be highly-motivated while possibly lacking certain academic skills to ensure the successful completion of their studies.

The lack of finances was another important factor. Since academic sponsorship from some of the students' companies was not guaranteed ("*not getting funding from my company*"), financial issues presented a possible challenge, especially for those responsible for their study fees ("*at the moment its finances*"). Other financially-related issues related to organising transport from work to university, especially in winter when it became darker earlier ("*transport in winter season*"). It would be to the benefit of the students to form teams and networks with their fellow students, not only from an academic support point of view, but also from a practical point of view. Furthermore, creating networks could possibly enhance their career prospects as all the students in this cohort were employed.

Academic readiness and curriculum-related issues were mentioned, including comments such as "*…assuming that every student grasps a concept the first time around*", "*scared to ask questions in class", and "improved scope for test and exams*". Future workshops could pay special attention to developing assertive communication in class. A parallel strategy could be raising the awareness of the academic staff to the insecurity often experienced by this student group. A concerted effort must be made to break down communication barriers by both academics and students. Academics must be encouraged to seek feedback, invite questions, and create opportunities for students to consult with them. Owing to many of the lecturers being employed full-time and

lecturing on a part-time basis, one suggestion could be to create notice boards and forums for discussion on the learning management system (Moodle).

Only two students mentioned challenges relating to feeling negative or demotivated. Comments included "*lack of motivation and support*". One of the benefits of the part-time workshops was that this cohort of students was made aware of and met support staff from the academic support unit and the student counselling centre. This facilitated easier communication as a connection had already been made and students felt more comfortable connecting with the support structures in place at the university.

The majority of students reported that they were motivated by their desire to improve themselves. They recognised the potential rewards of a better life once they achieved their formal qualifications. In light of supporting a humanised pedagogy (Zinn and Rodgers, 2012) and given the depressed economy and worrisome education levels of the Eastern Cape region, it was incumbent on the academic department to provide opportunities for access to higher education coupled with the required assistance to better support not only individual students, but the region as a whole.

The above-mentioned perceived challenges can be summarised as follows:

- challenges balancing work and home life
- stress related to studying part-time
- financial issues
- transportation issues
- academic readiness and curriculum-related issues
- feeling negative or demotivated

3. Methodology

A descriptive study with a quantitative approach was implemented through an online survey using QuestionPro. The objective was to understand the students' experience of the teaching and learning process using digital platforms during the pandemic. Of interest to the researchers were not only MPTS experiences with regards to EOTL, but also how EOTL experiences would resonate or compare with previous, pre-pandemic MPTS feedback.

The findings of this study are limited to those of the pilot study. Currently, a survey is being conducted among the entire cohort of MPTS. The cohorts who completed the pilot study were the final year MPTS (14 students), who would have commenced their first year of study in 2019. Thus, students would have received regular face-to-face instruction and learning during 2019 and 2020 (until April 2020) as well as extended instruction and learning during 2021 and 2022. In light of this, the small cohort of final-year students was therefore considered a representative sample of the entire population of MPTS. It should be noted that the University where this study is located has not yet returned to full pre-pandemic face-to-face teaching and learning.

4. Results and discussion

This section presents the results and discussion based on the following headings from the online survey: general teaching and learning preferences, teaching and learning aspects, resources, further education and skills, and balance and support.

4.1 General teaching and learning preference

The majority of respondents enjoyed EOTL and felt that it suited their particular learning styles. The majority also indicated that they preferred online or a hybrid approach which is a combination of online and face-to-face class attendance. The questions and responses are tabulated below.

Table 1: Suitability to individual learning style

In general, I find online learning different to face-to-face learning in a way that suits me and my learning style.		
Answer	**Count**	**Percent**
Yes	8	72.73%

In general, I find online learning different to face-to-face learning in a way that suits me and my learning style.		
No	3	27.27%
I'm not sure/I don't know	0	0.00%
Total	11	100%

Table 2: Rating of EOLTL

I enjoy the type of learning used during the COVID-19 pandemic.		
Answer	**Count**	**Percent**
Yes	8	72.73%
No	2	18.18%
I'm not sure/I don't know	1	9.09%
Total	11	100%

Table 3: Learning approach preference

I prefer the following learning approach		
Answer	**Count**	**Percent**
Attending normal classes	3	27.27%
Online learning only	4	36.36%
Attending classes and using online learning	4	36.36%
I'm not sure/I don't know	0	0.00%
Total	11	100%

Table 4: Online rating

I enjoyed working online on my modules		
Answer	**Count**	**Percent**
Strongly Agree	4	36.36%
Agree	5	45.45%
Neutral	0	0.00%
Disagree	2	18.18%
Strongly disagree	0	0.00%
Total	11	100%

Reasons for the high positive responses could be attributed to many working shifts and online learning enabled them to listen to the pre-recorded classes when it suited them. In addition, the students saved transportation costs. At the start of the pandemic, the university negotiated several support interventions for students, such as a laptop loan scheme and an allocation of free data for every registered student. Both of these arrangements assisted students greatly in managing and completing their academic studies. Based on these results, it would be recommended that a hybrid approach that functioned within the rules of the registration for the programme, be followed as much as possible.

4.2 Teaching and learning aspects

The majority of students *strongly agreed* or *agreed* that online teaching and learning (OLTL) allowed them to work at their own pace. Students would have been able to listen to the pre-recorded lecturers at any time, on their way to work, during breaks and after shifts. Travel time to campus was eliminated which could conservatively result in saving at least two to three hours travelling to attend a 5:30 pm class on campus that finishes at least 8 pm. Students would also be saving on transportation costs.

Due to the nature of assessing projects and assignments online, lecturers had to provide far more detailed feedback to students. The benefit of recorded feedback meetings allowed students to refer back to comments and suggestions from lecturers. The high positive response (73%) from respondents is an indicator that they felt

that online feedback improved their learning experiences. In addition, all modules were converted from examinable to continuous assessment, consequently, there was usually some form of assessment after each study unit in a module rather than the usual assessment strategy of two tests, one assignment and a final examination.

Table 5: Pace of work

In general, the current type of learning and teaching allows me to work at a pace that is suitable for me.		
Answer	**Count**	**Percent**
Strongly Agree	5	45.45%
Agree	4	36.36%
Neutral	1	9.09%
Disagree	0	0.00%
Strongly Disagree	1	9.09%
Total	11	100%

Table 6: Feedback

In general, the online feedback provided by the lecturer improved my learning experience.		
Answer	**Count**	**Percent**
Strongly Agree	3	27.27%
Agree	5	45.45%
Neutral	1	9.09%
Disagree	1	9.09%
Strongly Disagree	1	9.09%
Total	11	100%

Table 7: Effectiveness of EOLTL

I know and remember more about each module topic after completing each study unit online		
Answer	**Count**	**Percent**
Strongly Agree	4	36.36%
Agree	5	45.45%
Neutral	1	9.09%
Disagree	0	0.00%
Strongly Disagree	1	9.09%
Total	11	100%

Table 8: Knowledge transfer

Doing a module online results in me gaining more knowledge as opposed to if it were to be completed face-to-face		
Answer	**Count**	**Percent**
Yes	8	72.73%
No	3	27.27%
Total	11	100%

The majority of the students (63.6%) felt that online classes kept their interest and attention while 54% stated that they were not thinking or doing other things not related to their studies during an online lecture. Common feedback from lecturers however is that online lecturing can be extremely frustrating as one cannot see students' body language, there is no feedback, and students are slow to engage and respond. It could be helpful

to staff and MPTS to continue with as many continuous assessment modules rather than examinable modules. This will allow for more frequent assessments and more interaction.

Table 9: Interest and attention

In general, the online lessons are boring and do not catch my interest and attention		
Answer	**Count**	**Percent**
Strongly agree	1	9.09%
Agree	3	27.27%
Neutral	0	0.00%
Disagree	4	36.36%
Strongly disagree	3	27.27%
Total	11	100%

Table 10: Engagement

I often think about and do other things not related to the module when I am busy with an online lecture		
Answer	**Count**	**Percent**
Strongly agree	2	18.18%
Agree	0	0.00%
Neutral	3	27.27%
Disagree	6	54.55%
Strongly disagree	0	0.00%
Total	11	100%

4.3 Resources

Lecturers also become versed and competent in setting various types of assessments not previously used and capitalised on the features, such as quizzes, provided by the Moodle platform. Proactively the university provided extensive training and facilitation and support to equip lecturers, and orientated and trained students in the various facets of OLTL. This is evident in the positive responses tabled below indicating that additional resources were made available to students, the training provided and the increase in the number of assessments, in some cases eliminating “high stakes” assessments which did relieve some pressure on students. It would be important to continue with the training provided on the various online platforms. Such training can be undertaken in a face-to-face setting at the beginning of a semester to familiarise the students with their peers and lecturers. It is likely that this approach could possibly ensure a more effective introduction to hybrid teaching and learning.

Table 11: Additional course material

In general, the amount of additional online resources/content (like quizzes and videos) kept me interested in the course material		
Answer	**Count**	**Percent**
Strongly Agree	3	27.27%
Agree	6	54.55%
Neutral	0	0.00%
Disagree	2	18.18%
Strongly Disagree	0	0.00%
Total	11	100%

Table 12: Learning management system

In general, the module management system (such as Moodle or MS Teams) has been easy to navigate.		
Answer	**Count**	**Percent**
Strongly Agree	3	27.27%
Agree	6	54.55%
Neutral	1	9.09%
Disagree	1	9.09%
Strongly Disagree	0	0.00%
Total	11	100%

Table 13: Multiple resources as an aid

In general, having multiple resources (e.g. lessons and other forms of media) for each concept taught aided my understanding of the module.		
Answer	**Count**	**Percent**
Strongly Agree	3	27.27%
Agree	7	63.64%
Neutral	0	0.00%
Disagree	1	9.09%
Strongly Disagree	0	0.00%
Total	11	100%

4.4 Further education and skills

It was encouraging to see that 82% of respondents indicated that they were open to further education because of their online experiences. Previously, this would not have been a consideration to the apparent inaccessibility and unfamiliar nature of studying online. Furthermore, 91% of respondents indicated that they gained new skills which can have a positive impact on their confidence and employability. The department can endeavour to offer more short learning programmes online to further develop this cohort.

Table 14: Openness to further online courses

Based on my experience this semester, I could see myself learning and participating in other online courses (Excluding formal studies. For instance, an external short course such as for personal enrichment)?		
Answer	**Count**	**Percent**
Yes	9	81.82%
No	1	9.09%
I'm not sure/I don't know	1	9.09%
Total	11	100%

Table 15: Skills

I learnt many new skills during the duration of online learning.		
Answer	**Count**	**Percent**
Strongly Agree	4	36.36%
Agree	6	54.55%
Neutral	1	9.09%
Disagree	0	0.00%
Strongly Disagree	0	0.00%
Total	11	100%

4.5 Work-life balance and support

Apart from providing support in the form of laptops, data and training, the university provided constant support to address any mental health issues. In addition, the Engineering School's academic developer and advisor were available and would contact students to provide support when requested. If a lecturer detected any hint of a student battling or if they expressed any need for academic or personal support, they would be contacted for a consultation or referred for counselling sessions.

Based on the pre-pandemic student feedback, it is evident that one of the main challenges MPTS experienced was achieving a healthy work-life balance. However, in 2002, 73% of students indicated (*strongly agree* and *agree*) that online learning has enabled them to achieve a healthy work-life, and 73% stated that they felt supported as a mature part-time student.

Table 16: Work-life balance

Online learning has enabled me to achieve a healthy work-life balance		
Answer	**Count**	**Percent**
Strongly Agree	4	36.36%
Agree	4	36.36%
Neutral	2	18.18%
Disagree	1	9.09%
Strongly Disagree	0	0.00%
Total	11	100%

Table 17: Social support

I feel as though I have enough social support for online learning		
Answer	**Count**	**Percent**
Strongly Agree	3	27.27%
Agree	4	36.36%
Neutral	4	36.36%
Disagree	0	0.00%
Strongly Disagree	0	0.00%
Total	11	100%

Table 18: Support as a MPTS

I feel supported as a mature/part-time student		
Answer	**Count**	**Percent**
Yes	8	72.73%
No	3	27.27%
Total	11	100%

5. Conclusion

A previous, pre-pandemic study reported that MPTS experienced challenges in balancing work and home life. Being a student, attending classes, travelling to and from university, working full time, and juggling domestic and family responsibilities are daily issues faced by the MPTS. These stressors cause them to experience feeling pressured, stressed and anxious, and it is often compounded by the financial responsibilities either to their families or employers. Given these factors, the pressure of completing their studies successfully weighs heavily on them, often causing them to feel negative or demotivated.

The findings of the pilot study revealed that OLTL held great benefits for the MPTS. The greatest benefit is the flexibility that allowed students to study at a place and time that is convenient to them. This research will now be expanded to include all MPTS enrolled for the diploma to ensure that a representative voice direct more attention to OLTL challenges and inform how the curricula can be adapted to better suit this cohort of students.

Furthermore, the voice of academic staff needs to be included to sharpen attention on module pass rates. This research has harvested the lessons learnt during the pandemic and outlined the strategic interventions that brought about positive changes made to ensure better teaching and learning experiences to ensure student success. These benchmark findings must not be forgotten. However, a question emerges, "Are the PTMS trading the depth of academic knowledge and experience for the sake of convenience and to better balance work, family and being a student?" It is intended that the researchers will address this question in their ongoing research, as part of a larger research project. In order to answer this question, a mixed methodology will be used, which will include interviews and focus groups. In order to ensure retention and academic success of this unique cohort of mature employed students studying part-time, higher education institutions should improve the provision of support, as well as the learning and teaching experiences.

References

Bowl, M. (2010). Experiencing the barriers: Non-traditional students entering higher education. *Research Papers in Education*, 16:2: 141-160.

Lourens, A.S., Connelly, R.E., Plaatjes, R.C. Unpublished report (2018) Designing interventions to track the voice of marginalized part-time students. Unpublished report. Nelson Mandela University.

McVitty, D. & Morris, K. (2012). Never too late to learn: Mature students in higher education. Report by million+ and National Union of Students (NUS).

Parker, J.D.A., Summerfeldt, L.J., Hogan, M. & Majeskie. S.A. (2004). Emotional intelligence and academic success: examining the transition from high school to university. *Personality and individual differences*, 36(1):163-172.

Schuller, T. (2002, 14 May). Higher education: Opinion: Expanding higher education is a laudable target, but we must not forget that it is important for those over 30, too. *The Guardian*:13.

Taylor, G., Walton, E., Mellor, L. & McCarter, R. n.d. Mature students and widening participation. Active learning.

Zinn, D., & Rodgers, C. (2012). A humanising pedagogy: Getting beneath the rhetoric. Perspectives in Education. 30(4): 76–87.

Preferences of Grade R-12 Learners in South Africa for Digital Game-Based Learning

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Abstract: Evidence from the literature suggests that Game-based Learning (GBL) can help students learn better. A gamified environment can provide a blend of serious learning and fun for students. Some researchers have observed that GBL could stimulate valuable educational outcomes and positively impact a child's life. However, evidence shows that students in poor communities in South Africa are performing poorly academically due to poor student engagement and lack of motivation. Although GBL platforms are being used widely in some developed countries, they have not been widely adopted in South African schools. This paper provides insight on the preferences of learners in South African schools with respect to GBL. We conducted a survey involving participants from four South African Schools (2 Primary schools and 2 Secondary schools) to determine the type and mode of GBL that Grade R-12 learners prefer. A total of 193 learners participated in the survey. The study found the learners' preferential order of type of games are puzzles, video games, simulation games, word games, and card games. The aspects of visual aesthetics, musical scores, and incentive appeal to most learners. At the same time, there is also a preference for games that involves a challenge, enable competition with peers, and promotes curiosity. Based on our findings, we argue that multiplayer game platforms that have rich social interaction features would suit learners in South African schools, while single-player game platforms that can stimulate logical thinking and reasoning will also be helpful to aid learners in identified difficult subjects like Mathematics, Mathematical Literacy, Pure Science, accounting, and Geography. The study provides a solid foundation for understanding the requirements for developing GBL solutions to support education in South Africa. Furthermore, the study's findings could guide government policy on the adoption of GBL and software developers in making design choices during the development of GBL platforms.

Keywords: game-based learning, game design, computer games, game requirements, games development, child education

1. Introduction

These days more and more learners grow up using technology devices such as computers, smartphones, and play-stations to perform all sorts of activities (Katerina, 2020). The one activity that is common is playing games on these devices. In a week, it is said that young people spend an average of 7 hours playing games (Forbes, 2019). Therefore, it is important to take advantage of young people's interest and excitement in playing games to motivate them for serious learning.

The use of digital games has been proven to be efficient and effective in student learning. Without even realising it, students use digital games to learn, which makes these games the perfect tool to use in student learning (Katerina, 2020). Hence, there is a shift towards using digital learning in classrooms rather than traditional learning. These digital learning environments offer an opportunity to transform the teaching process using game elements to help motivate goals, stimulate users' attention, facilitate effective teamwork, promote competition, and help in communication (Subhash & Cudney, 2018).

The use of a digital learning environment through games is called Game-based Learning (GBL). GBL has evolved to help student learning (Subhash & Cudney, 2018). It is defined as the use of game mechanics by learners where they engage in a comprehensive learning experience through interactive cycles of assessment and feedback (Nadolny, 2019). Research has proven that digital game-based learning (DGBL) can help students to learn better, improve academic performance, motivation and interest, as well as facilitate more acquired knowledge by learners (Grivokostopoulou et al, 2019; Hwang & Chang, 2020; Bhandari, Hallowell, & Correll, 2019; Chang et al, 2020; Kao, 2020; Lee et al, 2016).

GBL as an approach has gained popularity in many different countries but has not been widely adopted in South Africa (Oliver, 2018). Many learners in South Africa (SA) schools that come from poor economic background are performing poorly in classrooms, which raises concern (Spaull & Kotze, 2015). Annual testing

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in numeracy and literacy within SA public schools showed poor performance and has raised many concerns regarding the SA education system (Ramrathan, 2017; Morrison, 2018). The score in international studies, including Trends in Mathematics and Science (TIMSS), places the Grade 8 learners in South Africa at the bottom of the 50 participating countries. Mathematics is an issue for South African learners as the international statistics show that they perform poorly in Mathematics compared to other learners of the same grades in other countries (Bosman & Schulze, 2018).

We argue that the adoption of digital game-based learning, which takes advantage of the love and passion that young people have for playing games, could be a solution to some of the challenges of learners in SA public schools. However, it is essential to have a clear understanding of learners' preferences if GBL were to be adopted so that government and education policy planners can formulate a suitable implementation strategy for GBL in South African schools. Thus, this study investigates the research question: *What types and modes of GBL are relevant to grade R-12 learners in South Africa?*

To answer this research question, we conducted a survey to determine the preferences of South African learners for GBL. The study involved 194 students in four South African schools (two primary schools and two secondary schools). We analysed the collected data using descriptive statistics to summarise our findings. The study is vital because it constitutes one of the first attempts to determine the preferences of South African learners for GBL. It will also provide a solid foundation for determining the requirements that a GBL platform for SA learners must satisfy in terms of its features, capability, and the critical design considerations for developing such a GBL platform. Furthermore, this study makes an academic contribution because it provides insight into the prospects of GBL adoption in South Africa and the preferences of SA learners for GBL, which hitherto has not been previously investigated. The study has positive implications for SA and other developing countries.

The rest of this paper is as follows. Section 2 presents background and related work. In Section 3, we describe the methodology adopted for the study. The analysis and results were presented in Section 4, while the discussion is presented in Section 5. Finally, the paper is concluded in Section 6 with a summary and an overview of our future research direction.

2. Background and related work

This section presents an overview of key concepts relevant to our study and a review of related work.

2.1 Challenges of R-12 learners in South Africa

There is an ongoing crisis in South African education, and the current education system has failed to address the needs of most South African youth (Spaull, 2015). Based on independently conducted assessments, Spaull (2013) reported that excluding the wealthy minority, a bigger part of the South African population is functionally illiterate and innumerate, while most South African pupils cannot read, write, and compute at a level equivalent to their grade.

In 2004, 72% of grade 6 learners failed the national literacy test. The figure was substantially higher in Mathematics, where 88% of all the Grade 6 learners failed to achieve the curriculum standard (Taylor, Fleisch & Shindler, 2007). The score in international studies, including Trends in Mathematics and Science (TIMSS), places the Grade 8 learners in South Africa at the very bottom of the 50 participating countries. Mathematics is an issue for South African learners as the international statistics show that they perform poorly in Mathematics compared to other learners of the same grades in other countries (Bosman & Schulze, 2018).

Furthermore, there is a high dropout rate of learners in schools and the fact that in South Africa, the overall progress in schools is slow. As much as 52% of learners repeat a grade at least once before they reach Grade 10 (Grossen, Grobler & Lacente, 2017). The majority of Black and Coloured learners still perform poorly compared to poorer African countries (Burgess et al, 2018).

During the Covid-19 lockdown, most schools shifted to online learning (Burgess & Sieverten,2020; Thomas, 2020). In terms of internet availability and affordability, African countries are ranked in the bottom third of countries, making online instruction a distant prospect for most people. As a result of such circumstances, the

strategy to move education online worsens inequality (Thomas, 2020). There is a substantial amount of evidence on the education crisis in SA, particularly in the disadvantaged communities.

2.2 Game-based learning

Gaming as a tool for learning is not a new concept in the education space, but in recent decades, it has evolved as computer technology and has become more common (Williams, 2019). Upon its release, Prensky's book (2001) had an impact on the discussion of GBL, and to date, it has still an impact. The author strongly supports the idea that the traditional teaching methods should be replaced, and learning should be centred on digital platforms and games; he claims that the earlier generations, compared to the future generations, which he calls digital natives think differently (Lindgren, 2016). More than 20 years later, in education research, digital game-based learning (DGBL) is no longer a new teaching tool (Tay, 2022).

Game-based learning (GBL) is the terminology that incorporates all types of learning that involves games, including gameplay, game design and gamification (Bolstad, 2018). Gamification is when game design elements are used in a non-game context, while GBL is when games are used in educational contexts to aid learning objectives (Subhash & Cudney, 2018). The most important feature of GBL environments is their capability to create effective and engaging learning environments (Emerson et al, 2020). Research suggests that DGBL has led to increased learning engagement (Annetta et al, 2009), increased flow experience (Liu et al, 2011), and improved course content understanding (Braghirolli et al, 2016; Wand and Abbas, 2018). It has also led to problem solving improvements (Hwang et al, 2012; Sanchez and Olivares, 2011) and higher academic achievements (Hwang et al, 2012; Philpot et al, 2005; Topalli and Cagiltay, 2018). GBL is important because of the key elements such as perseverance, player engagement, adaptivity, and graceful failure, which help in encouraging players to persevere when playing the game, think out of the box, and learn from their mistakes and adjust accordingly (Williams, 2019).

Major issues teachers face in schools are poor student engagement and a lack of motivation (Lee & Hammer, 2011; Subhash & Cudney, 2018; Robberts & Van Ryneveld, 2022). Thus, GBL has evolved as a measure to help student learning (Subhash & Cudney, 2018).

GBL can help South African grade R-12 learners by creating a positive influence in particular subjects like Mathematics and Science and introducing learners to various digital platforms to learn. However, to use digital game-based learning (DGBL) to help address the educational crisis in SA, an understanding of the preferences of grade R-12 learners for DGBL is necessary.

2.3 Related work

Although GBL is acknowledged as a successful learning platform, in the meta-analyses on GBL, some authors conclude that "the important question is not if but how game-based learning can support learning" (Clark et al, 2016). The authors argued that games could indeed support productive learning, but the game's design will determine and influence the efficacy of the learning environment (Clark et al, 2016).

According to Bolstad (2018), in his research study on GBL practices in New Zealand, he says the questions which come into play when researching GBL is: what game design features are particularly good for a specific learning type? He suggested that use of an ecological approach to understand GBL. The ecological approach is defined as relationships between any complex system and its environment and surroundings (Bolstad, 2018).

In the most recent study on mobile game-based learning in Science, Technology, Engineering and Mathematics (STEM), the authors concluded that instead of asking the question of whether mobile GBL is effective as an approach, what is essential is to identify how and why specific designs work in a particular circumstance (Gao, Li & Sun, 2020). Dimitra, Konstantinos & Christina (2020) looked at the types of GBL in education and advised that when looking at construction education games, the game must follow specific rules to be suitable for the group of learners it is addressing. The authors further advised that the game's purpose and type must be determined and tested by teachers to see if it meets the learning objectives.

In a more recent study by Tay et al (2022), which looked at designing DGBL for professional upskilling, the authors advised that it is vital to consider the type of games used in education and research. Each game type is

meant for a specific audience and objectives. For instance, some researchers chose to use off-the-shelf types of games instead of developing digital games for a particular purpose. This can result in issues such as relevance and the relationship between the game type and instruction objectives (Nousiainen et at. 2018; Sanchez et al, 2010). As advised in the literature, design is important in GBL because it influences the effectiveness of GBL in a learning environment. Furthermore, the type of game needed is also important, as each game type must be meant for a particular audience, for a specific learning objective.

GBL has not been widely adopted in South Africa as an alternative tool to enhance education (Oliver, 2018). Instead, e-learning platforms are used by many elite schools and universities. Thus, Oliver (2018) proposed implementing Technology-enhanced learning (TEL) and Digital Game-based Learning (DGBL) within theology in universities in South Africa. The author encouraged lecturers in South Africa to contribute to research on TEL and DGBL and experiment with and implement TEL and DGBL as part of their curriculum development endeavours. Also, M-Thuto is a mobile learning system in South Africa that supports learners in learning other languages that are not their first language (Jantjies & Joy, 2014). The tool is used to learn mathematics using other languages such as Tswana and English. Similarly, Kotnana et al (2010) conducted a study in SA on techniques to enhance GBL outcomes in Deaf and Dumb illiterates, while Kritzinger (2015) proposed the use of offline games to create cyber security awareness for R-12 learners in South Africa. Since GBL is not yet prominent in South Africa, thus far, no investigation on learners' preferences for digital game-based learning has been conducted, making our study vital for increased adoption of GBL in the South African educational system.

3. Methodology

3.1 Research approach

This study adopts a quantitative methodology and uses a deductive reasoning approach. Although the literature already states that GBL can aid students' learning (hypothesis), we sought to test this hypothesis in the south African context using empirical data.

3.2 Data collection

We collected data through a survey involving four schools (2 Primary and 2 Secondary schools) in the Western Cape Province of South Africa. We distributed a questionnaire to learners in the school with between 20 -50 participants from each school.

We sampled learners drawn from the foundation phase (Grade 1-3), intermediate phase (Grade 4-6), senior phase (Grade 7-9), and the further education and training phase (Grade 10-12). The teachers in the four schools were also surveyed, but information on this is not included in this paper. No specific type of learners was targeted in terms of gender or race, but all learners who agreed to participate were enrolled in the study. Before data collection, we obtained ethics clearance from the Ethics Committee of the Cape Peninsula of Technology, South Africa. We also got the approval of the Western Cape Department of Education to collect data from the schools. We obtained the informed consent of the management of each school and that of individual learners before they participated in the study. They also had the right to discontinue their participation at any time during the study. They also had the liberty to refrain from answering any question they were uncomfortable with (see Table 1).

Table 1: Participants of the study

School Names	Role	Total Participation	
		Selected	Responded
Group A	Learners in Primary School	50	50
Group B	Learners in Secondary School	50	44
Group C	Learners in Secondary School	50	50
Group D	Learners in Primary School	50	50
Total Respondents			194

The Survey questions aim to determine the preferences of the Grade R-12 learners to know the type and mode of GBL that suits them. Thus, the questionnaire items embraced the following aspects:

- The personality of the learners
- Learning Style of the learners
- The type of digital resources available to the learners
- The level of computer literacy of the learners
- Disposition of learners to game playing
- Frequency of playing games by learners
- The type of devices used to play games
- Type of games preferred by the learners
- Aspects of a game liked by the learners
- Elements of a game liked by the learners

The collected data was stored in a Microsoft Excel file to enable the data analysis.

3.3 Data analysis

We used descriptive statistics to analyse the collected data using frequency count and percentage score. We had 193 responses because one learner who agreed to participate in the study did not submit the questionnaire. Thus, there was a 99.5% response rate among the learners. We performed a theoretical analysis of recorded data and made deductions from observed patterns in the data.

4. Results

The results obtained from analysing various aspects covered by our questionnaire are presented as follows. Table 2 shows the different personality types and preferred learning styles of learners based on their responses. Almost half of the learners described themselves as friendly (49.22%), and many learners acknowledged that they were talkative (33.16%). In contrast, some others described themselves as shy (19.17%), quiet (15.02%) and thoughtful (13.98%), respectively. Also, more than half of the sampled learners (53.36%) described themselves as verbal learners that prefer to learn by reading or listening. A significant few see themselves as social learners (21.76%) that love to learn through social interactions while working in groups and teams. Some prefer working alone and self-study (20.76%). A few learners also describe themselves as visual (13.47%), kinaesthetic, logical, and aural learners.

Table 2: Personality and learning styles

Personality	**Percentage**
Action-oriented	4.14 %
Outgoing	6.21 %
Reserved	7.77 %
Social	8.8 %
Thoughtful	13.98 %
Quiet	15.02 %
Shy	19.17 %
Talkative	33.16 %
Friendly	49.22 %
Learning Styles	**Percentage**
Aural	6.73 %
Logical	7.25 %
Kinaesthetic	7.77 %
Visual	13.47 %
Solitary	20.72 %
Social	21.76 %
Verbal	53.36 %

Figure 1 captures the type of access to digital resources that the learners have, while Figure 2 shows the disposition of learners to game playing. The result indicates that fewer learners have access to computers and cell phones at school while more learners have access to computers (64.43%) and cell phones at home (69.94%). In addition, few learners did not respond to the questions about access to digital resources. Also, the learners that play computer games (77.72%) are significantly more than those that do not play computer games (21.24%).

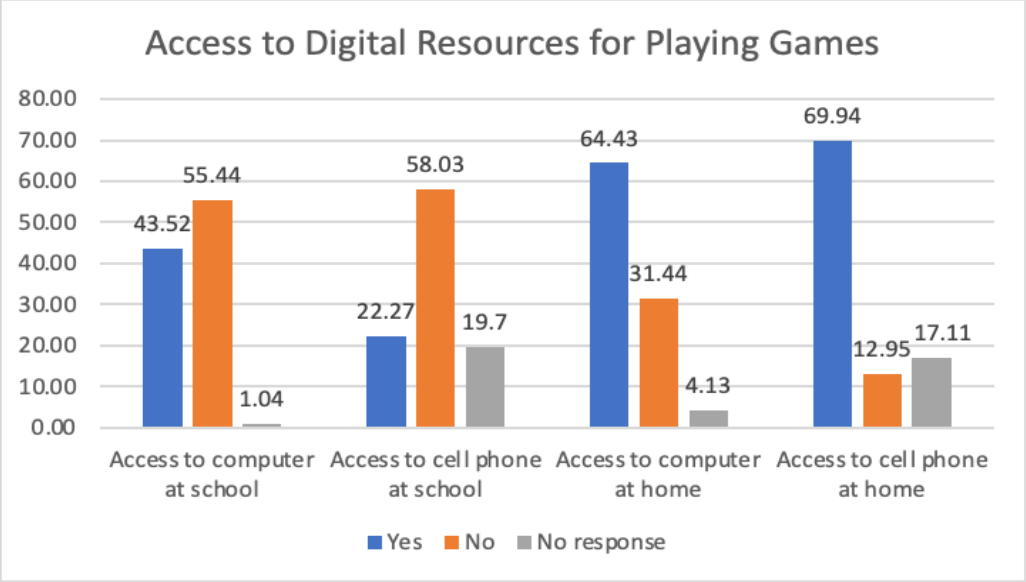

Figure 1: Learners' access to digital resources

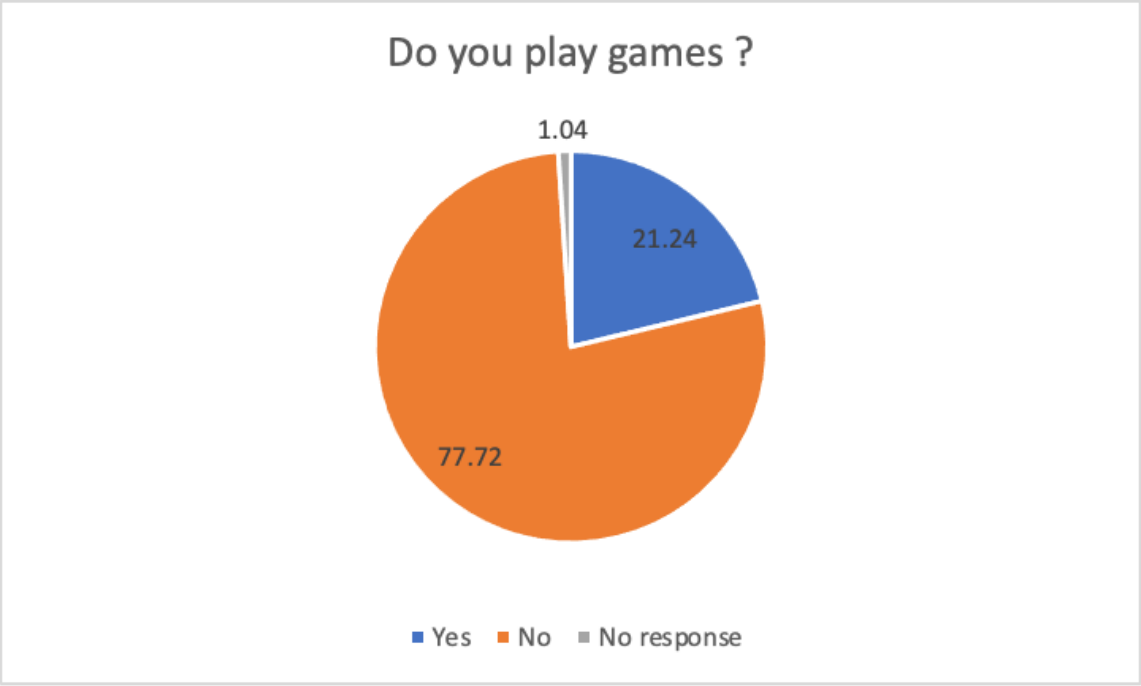

Figure 2: Disposition of learners to game playing

Table 3 shows how frequently the learners play games and the types of devices used to play games. More than 38% of the learners claim to play games almost every day, while others play games once or twice a month (30.56%), and a small number of learners play games once a week (26.94%). The result also showed that most learners use smartphones to play games.

Table 3: Frequency of playing games and devices used

How often do you play	Percentage
Once a week	26.94 %
Once or twice a month	30.56 %
Almost Every day	38.34 %
Devices used to play games	**Percentage**
Video game devices	4.14 %
Computer tablet	6.21 %
Computer	6.73 %
Console - PlayStation	9.84 %
Smartphones	73.05 %

Table 4 reveals the preference of learners in terms of the type of games they like, the specific aspects of a game that they like, and the elements of a game that they find interesting. More learners indicated that they like puzzles (34.71%) and video games (31.6%). At the same time, some learners showed that they liked word games (26.42%), simulation games (20.20 %) and card games (13.98%), while a small group liked board games (8.29%) and role-playing games (8.8%)**.** In addition, most learners like aspects of a game that involves rewards in the form of visual aesthetics (36.26%) and musical scores (35.75%), while some like aspects of the incentive systems (28.49%) and the game narrative (22.27%). A small group of learners indicated that they like the game mechanics aspect (8.8%).

We also found that key elements of a game liked by learners are challenging games (36.21%), as well as games that enable competition with others (31.08%) and trigger curiosity games (20.72%). Fewer learners liked collaborative (15.02%) and fantasy games (10.88%). We also found that 84.45% of the learners believe that playing games can help them learn better, while 83.41% think that playing games can help them learn subjects they perceive as difficult. Some of the learners listed Mathematics, Pure Science, Commercial subjects (Accounting), Mathematical Literacy, and Geography as difficult subjects.

Table 4: Game preferences of learners

Type of games preferred	Percentage
Board games	8.29 %
Role-playing	8.8 %
Card games	13.98 %
Simulation	20.2 %
Word games	26.42 %
Video games	31.6 %
Puzzles	34.71 %
Aspects of the game liked	**Percentage**
Game mechanics	8.08 %
Narrative	22.27 %
Incentive systems	28.49 %
Musical score	35.75 %
Visual aesthetics	36.26 %
Elements of the game liked	**Percentage**
Fantasy	10.88 %
Collaborative	15.02 %
Curiosity	20.72 %
Competing with others	31.08 %
Challenge	36.21 %

5. Discussion

Based on the results obtained from the study, we shall discuss our findings as it relates to the personality types of learners, access to digital resources, the disposition and frequency of playing games, the type of games liked by learners and the attributes that they find interesting. We also discuss the implication of these for difficult subjects and the adoption of digital GBL in South Africa.

- **i. Personality of learners:** since most learners describe themselves are either friendly or talkative or both (see Table 2), game-based learning platforms that can stimulate social interaction such as multiplayer games for learning should be encouraged. Considerable effort should also be made to invest in single-player game platforms since a significant number of learners (one-third of the percentage of learners) believe that they are quiet or shy. This will ensure that all personality types are catered for adequately. According to Oliver (2018), GBL has not been widely adopted in South Africa as an alternative tool to enhance education. Thus, designing game platforms that suit learners' personalities will aid the diffusion of GBL as a tool for improving learning in SA schools.
- **ii. Learning style of learners:** our results show that verbal learning is the most preferred form of learning among the learners (1 out 2 learners), while social learning (1 out of 5 learners), solitary learning (1 out of 5), and visual learning (approximately 1 out 8 learners) are moderately preferred (see Table 3**)**. This observation justifies the need to focus on the design of GBL platforms that will encourage social interactions and multiplayer games. Since very few learners identify themselves as logical learners that love solving problems either by explaining and interpreting texts or solving mathematics, GBL platforms that can stimulate logical thinking and reasoning are also needed in SA schools.
- **iii. Digital game resources, disposition to games, and frequency of playing games among learners:** more learners have access to digital resources at home than at school. Many schools have computers, but the ratio of available PCs to learners is high, which means that the computer systems in schools cannot be sufficient to support learners' quest to play games. The majority of the learners play games almost every day. Some play games once a week or more than once a month (see Table 3). Learners do not have access to use cell phones while in school, but they have access to cell phones and smartphones a home. The smartphone penetration in South Africa is over 80%, the highest in Africa (Gilbert, 2019). Since most learners love to play games, the high number of smartphone owners in South Africa makes it possible for many learners in South Africa to have access to digital resources for digital game playing. This is a good foundation for the wider adoption of GBL in South Africa.
- v. **Types of games and aspects and elements of games that learners like:** Since most learners like puzzles and video games, while word games, simulation games, and card games are also fairly popular, game designers need to invest more effort in developing game platforms that possess these characteristics (see Table 4). Features such as visual aesthetics and musical scores rank high on the scale of preferred game requirements from the learners' perspectives; hence GBL platforms for SA learners must have these aspects. Games that demand solving a challenge and facilitate competition among multiple players are attractive to most learners. These types of games can stimulate the development of problem-solving skills of learners. Games that are based on curiosity (1 out of 5 learners like this type of game) and those that encourage collaboration (liked by approximately 1 out of 7 learners) and fantasy (liked by 1 out of 10 learners) are also viable options to explore in developing GBL platforms for SA learners.
- **iv**. **Game-based learning and difficult subjects;** Most learners find it difficult to learn Mathematics, Mathematical Literacy, Pure Science, Commercial subjects (such as Accounting), and Geography. Considering that very few learners indicated a preference for a logical learning style, many learners experience difficulty in learning subjects that require calculations. GBL can be used to promote more logical reasoning and learning among learners. The fact that most students love puzzle games provides a good rationale to explore further the implementation of games that can train learners in logical thinking and logical reasoning that will aid their abilities in the difficult subjects, which agrees with the perspective of Grivokostopoulou et al (2019). The impact of this over the long term will be the improvement of the performance of SA learners in Mathematics which, according to Bosman & Schulze (2018), has been poor over the years.

6. Conclusion

In this paper, we have presented the preference of learners in South Africa for game-based learning (GBL). Digital GBL is not yet prominent as an alternative for enhanced student learning in South African schools.

Therefore, an understanding the type and mode of GBL preferred by learners is essential to guide the implementation of GBL in SA schools. After analysing survey data collected from four schools in the Western Cape Province of South Africa, we found that most students identify themselves as verbal or social learners, friendly or talkative in terms of personality and preferred learning style, respectively. There was also a fewer but significant percentage of learners with shy or quiet personalities in the sampled population. They were also learners that identified themselves as solitary learners who prefer to study alone, while a few indicated their preference for visual learning. Most learners play games and love to play games, mainly using smartphones. Puzzles and video games are the most popular among learners, while simulation, word games, and card games are also popular. Games that incorporate aspects of visual aesthetics, musical scores and incentive systems are liked by most learners. There is also a preference for games that involves a challenge, enable competition with peers, and promotes curiosity. Thus, generally, multiplayer game platforms that are rich in these social interaction features are desirable for SA learners. There is also a need for single-player game platforms that can stimulate logical thinking and logical reasoning, which can help learners develop logical abilities that will make difficult subjects such as Mathematics, Mathematical Literacy, Pure Science, Accounting, and Geography easier to learn.

As a contribution, this paper has provided insight into the type and mode of GBL that is preferred by SA learners, which is a topic that has gained limited or no attention before now. Thus, the insight from the study provides a first empirical basis for understanding the requirements of a digital GBL for learners in SA, which is also relevant to other developing countries that share contextual characteristics with South Africa. We shall focus on eliciting the key requirements that a platform for digital GBL for South African learners must satisfy in future work.

References

Annetta, L. A. Minogue, J. Holmes, S. Y. and Cheng, M.-T. (2009) Investigating the impact of video games on high school students' engagement and learning about genetics.

Anderton, K. (2019) Research Report Shows How Much Time We Spend Gaming.Retrieved from *https://www.forbes.com/sites/kevinanderton/2019/03/21/research-report-shows-how-much-time-we-spend-gaming-infographic/#1a9602d13e07*

Bolstad, R. (2018) Researching game-based learning practices in Aotearoa New Zealand.

Bosman, A. and Schulze, S. (2018) Learning style preferences and Mathematics achievement of secondary school learners.

Burgess, S. and Sievertsen, H. (2020) Schools, Skills, and learning: The impact of COVID-19 on education.

Bhandari, S. Hallowell, M. R. and Correll, J. (2019) Making construction safety training interesting: A field-based quasi-experiment to test the relationship between emotional arousal and situational interest among adult learners.

Braghirolli, L. F. Ribeiro, J. L. D. Weise, A. D. and Pizzolato, M. (2016) Benefits of educational games as an introductory activity in industrial engineering education. *Computers in Human Behavior*, *58*, 315-324.

Clark, D. B. Tanner-Smith, E. E. and Killingsworth, S. S. (2016) Digital games, design, and learning: A systematic review and meta-analysis. *Review of educational research*, *86*(1), 79-122.

Chang, C. Y. Kao, C. H. Hwang, G. J. and Lin, F. H. (2020) From experiencing to critical thinking: A contextual game-based learning approach to improving nursing students' performance in electrocardiogram training. *Educational Technology Research and Development*, *68*(3), 1225-1245.

Gao, F. Li, L. and Sun Y. (2020) A systematic review of mobile game-based learning in STEM education.

Gilbert, P (2019) SA smartphone penetration now at over 80%, says ICASA. Available at: https://www.itweb.co.za/content/GxwQDM1AYy8MlPVo

Grivokostopoulou, F. Kovas, K. and Perikos, I. (2019) Examining the impact of a gamified entrepreneurship education framework in higher education.

Grossen, S. Grobler, A. and Lacente, M. (2017) Repeated retention or dropout? Disputing Hobson's choice in South African township

Hwang, G.-J. Wu, P.-H. and Chen, C.-C. (2012) An online game approach for improving students' learning performance in web-based problem-solving activities. *Computers & Education*

Hwang, G. J. Wu, P. H. Chen, C. C. and Tu, N. T. (2016) Effects of an augmented reality-based educational game on students' learning achievements and attitudes in real-world observations. *Interactive Learning Environments.*

Hwang, G. J. and Chang, C. Y. (2020) Facilitating decision-making performances in nursing treatments: A contextual digital game-based flipped learning approach. *Interactive Learning Environments*

Jantjies, M. and Joy, M. (2014) Mobile Enhanced Learning in a South African Context.

Kao, C. W. (2020) The effect of a digital game-based learning task on the acquisition of the English Article System.

Katerina, T. (2020) Types of Game-Based Learning in Education: A brief state of the art and the implementation in Greece.

Peffers, K. Tuunanen, T. Rothenberger, M. A. and Chatterjee, S. (2007) A design science research methodology for information systems research. *Journal of management information systems*, *24*(3), 45-77.

Kotnana, R. Sulaiman, A. and Jesudoss, A. (2010) Game based learning: a beacon of hope for deaf and dumb people in african countries. In *European Conference on Games Based Learning* (p. 508). Academic Conferences International Limited.

Kritzinger, E. (2015) Enhancing Cyber Safety Awareness among school children in South Africa through gaming.

Lee, J., & Hammer, J. (2011). Gamification in education: What, how, why bother?

Lee, Y.H. Dunbar, N.E. Miller, C.H. Lane, B.L. Jensen, M.L. Bessarabova, E. Burgoon, J.K. Adame, B.J. Valacich, J.J. Adame, E.A. and Bostwick, E., (2016) Training anchoring and representativeness bias mitigation through a digital game.

Liu, C.-C. Cheng, Y.-B. and Huang, C.-W. (2011) The effect of simulation games on the learning of computational problem solving. *Computers & Education.*

Morrison, S. (2018) Developing early number learning using maths recovery principles.

Nadolny, L. (2019) The amazing world of game-based learning. Retrieved from https://www.drnadolny.com/gamebasedlearning.html.

Nousiainen, T. Kangas, M. Rikala, J. and Vesisenaho, M. (2018) Teacher competencies in game-based pedagogy. *Teaching and Teacher Education*, *74*, 85-97.

Oliver, N. (2018) Digital game-based learning and technology-enhanced learning for theological education.

Philpot, T. A. Hall, R. H. Hubing, N. and Flori, R. E. (2005) Using games to teach statics calculation procedures: Application and assessment.

Prensky, M. (2001) Digital game-based learning.

Robberts A.S. and Van Ryneveld L. (2022) Design principles for introducing 21st century skills by means of game-based learning.

Sanchez, A. Cannon-Bowers, J. A. and Bowers, C. (2010) Establishing a science of game-based learning.

Sánchez, J. and Olivares, R. (2011) Problem solving and collaboration using mobile serious games.

Spaull, N. and Kotze, K. (2015) Starting behind and staying behind in South Africa: The case of insurmountable learning deficits in mathematics.

Spires, A. (2015) Digital Gamed-Based Learning.

Subhash, S. and Cudney, A. (2018) Gamified learning in higher education: A systematic review of the literature.

Tay, J. Goh, Y. M. Safiena, S. and Bound, H. (2022) Designing digital game-based learning for professional upskilling: A systematic literature review. *Computers & Education*, 104518.

Taylor, N. Fleisch B. and Shindler J. (2007) Educational Scenarios for 2019.

Thomas C J. (2020) Coronavirus and challenging times for education in developing countries.

Topalli, D. and Cagiltay, N. E. (2018) Improving programming skills in engineering education through problem-based game projects with Scratch.

Wang, Q. and Abbas, M. (2018) Designing web-games for transportation engineering education. *Computer Applications in Engineering Education.*

Williams, F. (2019) Using Game-Based Learning to better engage learners in Agricultural Environments, pp.1-2

Redefining Quality Assessment in Canadian K-12 Schools With Empathy, Critical Consciousness and Metacognition

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Abstract: Over the past decades, educational pedagogies have been shaped by many theorists and frameworks. For the purpose of this paper, the researchers define educational pedagogy through a lens that is influenced by Paulo Freire. For instance, educational pedagogy can be defined as seeking a balance within the tension between freedom and authority, while navigating the challenging structures that shape educational institutions (Freire, 2005, 2020). These structures include the impact of lived experiences and realities, the role of curricula, and the changing interactions within society that influence the pedagogical frameworks in education (Freire, 2020). This paper begins to consider a new framework for assessment and evaluation in Ontario, Canada's K-12 schools, where educational pedagogy, empathy, metacognition, and critical consciousness may be posited as potential components moving forward. This paper deeply examines these three key elements of effective and authentic assessment: empathy, critical consciousness and metacognition. Each of these terms is defined and situated in a 21C digital learning context, and the authors suggest that new directions in assessment and evaluation must consider these three significant as fundamental to any redesign of assessment practices. Consideration may be given to the perspectives and experiences of educational leaders, educators, students, and their communities, and how these perspectives can shape the values and how we meet the challenges in education. Pedagogy in practice can often reflect the strategies and beliefs that influence educators' values and choices, and the resulting impact on learning. Part of these pedagogical considerations may include the development of empathy, critical consciousness and metacognition throughout the assessment and evaluation process. Using a Canadian context, the authors argue that post-pandemic learners require a different set of tools to learn, and post-pandemic teachers need to reconfigure the ways in which that learning is measured, assessed and evaluated.

Keywords: assessment, critical consciousness, metacognition, empathy, digital age

1. Introduction

The overarching premise of this discussion paper is to examine the fundamental concepts of empathy, metacognition and critical consciousness as they relate to assessment and evaluation systems in Ontario, Canada's K-12 schools. While events like the COVID-19 pandemic may have led to shifts in pedagogical practice, longstanding assessment strategies have remained in education for centuries (Blum, 2020; Crooks, 1993; Kohn, 1994). As we navigate the next decades of educational development, students may need to develop new skills and competencies. Some would posit that we are in a Fourth Industrial Revolution (4IR), and as a result, there are changing competencies and skills that employers and institutions increasingly seek (Giammarco et al., 2020; Gray, 2016; Voogt et al., 2013; Waddell et al., 2018). The 4IR acknowledges the rapid change to technology and the impact on industry, societal patterns and processes, and the interconnectedness between technology and human interaction (Gray, 2016; Giammarco et al., 2020; Waddell et al., 2018; Voogt et al., 2013). As a result, skills such as creativity, problem-solving, negotiation and critical thinking, are suggested by numerous stakeholders in industry as potential competencies needed by students as they emerge from K-12 years (Gray, 2016; Schwab, 2018; World Economic Forum, 2016). The skills and assets that could be viewed as important for students in Ontario, Canada's K-12 schools have consequently changed over time. 21st century (21C) competencies reflect a set of themes, skills, and support systems that are seen as valuable for future life and career development (Barell, 2010; Canadians for 21st Century Learning and Innovation, 2012; Marzano and Heflebower, 2011). Growing Success (Ontario Ministry of Education, 2010) was published in Ontario, Canada over a decade ago and may not be reflective of these themes and skills. Empathy, metacognition, and critical consciousness can be integral to these emerging skills and provide value to the K-12 education system in Ontario, Canada.

Additionally, digital learning spaces may also be considered as technology continues to influence what is considered an environment for learning and skill development. The impact of the COVID-19 pandemic has changed several ways educators and students interact in various learning environments, both online and in-person (Luettchau, 2021; Oyedotun, 2020). There is a wide variety of types of online learning environments that each offer very different learning experiences (e.g. asynchronous, synchronous, blended, hybrid). One model, the Fully Online Learning Community (FOLC), posits how digital spaces are dynamic and co-created among educators and students through synchronous and asynchronous learning opportunities (Blayone et al., 2017). Further to this, Balkaya and Akkucuk (2021) explored how learning management systems (LMS) have an increasing impact on digital learning spaces, acting as an online extension or substitution of the physical classroom. These online learning systems can allow students and educators to collaborate with global colleagues, and provide opportunities to build self-paced learning strategies to manage individual goals and assess growth (Balkaya and Akkucuk, 2021). For example, Cox et al. (2018) argued how technology can provide students with opportunities to connect with others around the world, access materials, seek feedback, and investigate physical spaces through a technological lens. However, digital inequalities need to be addressed as online learning environments increase, and educators will require adequate opportunities to build capacity on strategies and pedagogical considerations in online learning environments (Luettchau, 2021; Oyedotun, 2020). Students and their communities should be considered when addressing barriers to online learning and how to best engage students in digital spaces (Chapman et al., 2020; Luettchau, 2021; Oyedotun, 2020).

It may be important to consider the role of assessment and evaluation through emerging concepts such as the 4IR and 21C, and how these concepts can encourage empathy, metacognition, and critical consciousness both in-person and in digital learning spaces.

For instance, empathy is a core skill where human relationships are fostered through understanding, active listening, and communication (Brett et al., 2003; Blasco and Moreto, 2012; Goleman, 2005). Recognizing that emotions are complex, empathy asks that one considers the point of view of another while acknowledging that one's feelings and thoughts are individual (Brett et a., 2003; Blasco and Moreto, 2012). Assessment and evaluation in Ontario, Canada require an evaluative grade, and these grades may not communicate learning in a meaningful and clear way (Blackwelder, 2020; Blum, 2020; Kohn, 1999; Stommel, 2020) and often ignore the understanding and relationship building that empathy requires. It can be important to reflect on one's empathic responses, as a path towards deeper reflection which leads to metacognitive skills. These reflective strategies can also be encouraged through metacognitive skills.

Metacognition and critical reflective practices play an essential role in deep learning and foster a strong sense of the journey that is learning (Blum, 2020; Brookfield, 1998; Veenman et al., 2006). Brookfield (1998) discussed the lenses of critical reflection, including understanding our autobiographies as learners and understanding how personal experiences shape our understanding of how we learn and impact how educators may view and understand learning themselves. The structures in society combined with one's personal experience and values can impact how one can reflect on their learning and lived experiences (hooks, 1994; Brookfield, 1998; Immordino-Yang et al., 2018). In order to effectively reflect on how one learns, they need to feel safe in their learning environment regardless of race, gender, orientation, or class (hooks, 1994, Immordino-Yang et al., 2019; Immordino-Yang et al., 2018). Ontario's Growing Success (Ontario Ministry of Education, 2010) document defines metacognition as "thinking about one's own thought process" (p.149), without providing a rationale for its effectiveness, implementation strategies for educators and students, or mention of the impact it has on learning. Further consideration can be given in Ontario, Canada's document to inform metacognitive skills in assessment practices While deepening one's own understanding may be crucial in assessment, consideration can also be given to developing a critical awareness of more broader lived experiences through a critically conscious lens.

Freire (2005) describes critical consciousness as a sociopolitical tool that considers one's historical and social position and the impact that position has on shaping their reality. Critical theorists assert that one must question their individual, social, and cultural position and how societal structures uphold those positions (Blake and Masschelein, 2003; Freire, 2005). Thus, an in-depth understanding of the world and one's perception of the world may require a critical view of systemic inequities and take action against these systems (El-Amin et al., 2017; Freire, 2005; hooks,

1994). Ontario's Growing Success (Ontario Ministry of Education, 2010) can also consider critical consciousness in their assessment document to help inform skill development and deepen understanding.

2. Operational definitions

Over the past decades, *educational pedagogies* have been shaped by many theorists and frameworks. For the purpose of this study, the researchers define educational pedagogy through a lens that is influenced by Paulo Freire. For instance, educational pedagogy can be defined as seeking a balance within the tension between freedom and authority, while navigating the challenging structures that shape educational institutions (Freire, 2005, 2020). These structures include the impact of lived experiences and realities, the role of curricula, and the changing interactions within society that influence the pedagogical frameworks in education (Freire, 2020). Pedagogical considerations may include the development of empathy as a means of building relationships between educators, students, and their families, throughout the assessment and evaluation process.

Empathy is a powerful emotion connected to the affective domain, which refers to one's feelings, cognition, and outward behaviours (Brett et al., 2003). By intentionally developing empathetic attitudes, the affective domain is triggered and provides an opportunity to understand the expansive range of emotions and resultant behaviours in response to these emotions (Blasco & Moreto, 2012; Brett et al., 2003). Grades can dehumanize the education system and harm the people learning within that system (Holt, 2004). The grading system diminishes our ability to understand the many factors that impact the learning process and reduces that judgement to a value or number. Goleman (2005) discusses emotional intelligence as the ability to hone in on one's emotional impulse and read and recognize emotions in others. The notion of being emotionally intelligent calls us to consider how one understands and acknowledges the emotional capacity of those around them (Goleman, 2005).

Furthermore, *metacognition* is thinking about how you learn and how what is learned may be relevant, mainly when framed within one's beliefs, values, and experiences (Brown et al., 2014; Flavell, 1979; hooks, 1994). Being reflective and understanding how we learn are essential. However, our learners need to feel safe and nurtured in their environment for reflection, learning, and risk-taking to be effective (Immordino-Yang et al., 2018; Immordino-Yang et al., 2019). To do well, we must *feel* well, starting with building a safe space that reflects the needs of each individual.

Finally, *critical consciousness* is an integral sociopolitical tool that asks learners to question their historical and social situations based on reality (Freire, 2005). Grounded in critical theory, the essential value of consciousness lies in its inherent demand for one to question individual, social, and cultural developments while simultaneously interrogating how social and economic structures are produced and reproduced (Blake and Masschelein, 2003). Education is one of many systems and, like many systems, can support and perpetuate inherently oppressive ideologies (Freire, 2005; hooks, 1994). It is crucial that our society's look at the systemic barriers presented in our world, and our students must be equipped with the skills and knowledge to interrogate and question these systems.

3. Overview of Canadian Provincial assessment guidelines

Growing Success (Ontario Ministry of Education, 2010) defines assessment as "the process of gathering information that accurately reflects'' (p. 28) how a student is meeting curriculum expectations, while evaluation is "judging the quality of student learning" (p. 38) concerning set standards of achievement and assigning value to that quality; in essence, the process of assigning a 'value' to one's learning. Assessment and evaluation can be far more nuanced than Growing Success's (Ontario Ministry of Education, 2010) suggestions. Considering what and how we assess, and determine what to evaluate, requires thoughtful interrogation into factors like curriculum design, school leadership, systemic barriers, and the pedagogy of staff or the entire school (Blum, 2020; Kohn, 2020; Stommel, 2020; Chu, 2020). The purpose of assessment can be argued as pervasive, providing lifelong skills that foster critical reflection of growth, knowledge, and applying constructive feedback (Boud and Falchikov, 2007; Fu et al., 2018; O'Connor and Lessing, 2017). Where Growing Success (Ontario Ministry of Education, 2010) posits assessment and evaluation as a means to prescribe a value to learning, research suggests we consider the vastness and diversity in the factors that foster learning and promote authentic means of assessment (Bialystok and Kukar, 2018; Cumming and Maxwell, 1999; Herrington et al., 2014; Swaffield, 2011; Vu and Dall'Alba, 2014).

Assessment is the collection of evidence that describes how pedagogy shaped the learners' growth, leaving the evaluation as the narrow measure of specific skills or capacities (Herrington, 2014; McDonald 2012). New terminology - like authentic assessment, ungrading, gradeless assessment, portfolio and contract assessment - has taken shape throughout the decades (Bialystok and Kukar, 2018; Blum, 2020; Herrington, 2014; McDonald 2012; Sackstein, 2015) in an attempt to redefine and understand more deeply the multifaceted world that is assessment and evaluation of learning.

Formative Assessment

Formative assessment uses gathered evidence of learning by educators, peers, and learners to decide the next steps in the learning journey (Black and Wiliam, 2009). Often, exemplars of formative assessment can include assigned homework, reflections, quizzes or 'exit passes,' tests, and examinations (Black and Wiliam, 2009). Growing Success (Ontario Ministry of Education, 2010) defines formative assessment as an assessment that "takes place during instruction to provide direction for improvement [and] adjustment to instructional programs for individual students and a whole class." (p. 147). Thus, emerging terms like an assessment for, as, and of learning take shape to structure pedagogical assessment.

Assessment for, as, and of learning

Assessment for learning is "the process of seeking and interpreting evidence for use by learners and their teachers" (Assessment Reform Group, 2002, p. 2); assessment as learning focuses on the "fostering of students' capacity over time to be their own best assessors" (Western and Northern Canadian Protocol, p. 42); and assessment of learning is what often "becomes public and results in statements or symbols about how well students are learning" (Western and Northern Canadian Protocol, p. 55). Interestingly, Growing Success (Ontario Ministry of Education, 2010) defines assessment of learning as the understanding that it "often contributes to pivotal decisions that will affect students' futures" (Western and Northern Canadian Protocol, p. 55). Therefore, it is possible to interpret that Ontario's assessment and evaluation document could support this notion that evaluation as grades can impact students on such a deep level it can infringe on their future.

4. Technology and assessment

Numerous models of online learning communities have been developed, such as the Community of Inquiry framework (Garrison et al., 2010), Communities of Practice (Li et al., 2009), and the Fully Online Learning Community (FOLC) (vanOostveen et al., 2016). These online communities integrate structures and social interactions into digital learning spaces, and articulate how technology can shape learning communities (Garrison et al., 2010; Li et al., 2009; vanOostveen et al., 2016). Technology has also influenced assessment practices, as multimedia tools like collaborative learning platforms and digital feedback strategies can foster collaborative, integrated and interdependent learning environments (Herrington and Herrington, 1998; Reeves et al., 2002; Reynolds, 2010; Timmins et al., 2016). Digital tools can aim to support assessment and evaluation practices that reflect the learning outcomes required in the 4IR. For example, online portfolios or learning management systems (LMS) can provide learners with frequent and continuous feedback documented in a single digital space (Reynolds, 2010). Technology also allows students to curate samples from their learning, reflect on their strengths, and identify next steps provided in response to feedback (Chiaravalli, 2020; Reynolds, 2010; Sackstein, 2020). Barber (2020) discussed the use of digital moments, replicating in-person relationship building activities by uploading images or quotes to create community. Technology can provide tools and strategies such as digital moments that promote a sense of safety, inclusion, and creativity when educators and students engage in dialogue related to assessment and evaluation (Barber, 2020). Consideration should also be given to technological inequity with respect to access to connectivity and devices, personal privacy, and accessibility tools (Timmins et al., 2016).

5. Conclusion: The intersection of metacognition, empathy, culture of care

The researchers found that the literature in this study supported how developing a culture of care through empathy can play an essential role in Ontario, Canada's assessment practices (Boske et al., 2017; Carroll and Mcbain, 2021; Hartman et al., 2017; Nojan, 2020). Educators and educational leaders can apply empathic ways of connecting with

students and their families, and recognize the role that empathy can play in assessment practices. Berkovich (2020) found that empathy was identified as one of the most ideal traits for educators to embody. Educators and educational leaders can build new ideas and constructs based on the lived experiences of their students, and aim to prioritize empathy when implementing assessment practices. Furthermore, it is important to also recognize how educators may need to receive empathy, supporting their personal and professional growth in order to provide support to their students (Berkovich, 2020). The researcher found that the value of a caring culture should be considered with respect to assessment practices. This commitment to build trust and empathy can foster strong community relationships where students and their families could feel safe and valued regardless of race, ethnicity, gender, sexuality, or socioeconomic status (Boske et al., 2017; Bourke and Mentis, 2014; Casale et al., 2018; Conrad, 2020). Growing Success (Ontario Ministry of Education, 2010) only mentions empathy twice, and could aim to consider the role of empathic responses in assessment. However, this foundation of trust and empathy should be an ongoing commitment that continually aims to honour the voices of their community and be responsive in their practice. A reflective learning community can be a foundation of a caring and empathetic culture.

This type of supportive learning environment can provide ideal conditions for students to develop skills in metacognition, critical thinking, risk taking and growth. Metacognition involves thinking about one's own thinking process, habits, and strategies that contribute to learning and reflection (Brookfield, 1998; Blum, 2020; Veenman et al., 2006). The researcher found in the literature that supportive communities, involving educators, students, and their families, could allow individuals to think metacognitively, reflecting on their own experiences and understandings, and recognize personal strengths to develop goals for each individual need (Berkovich, 2020; Bourke and Mentis, 2014; Hechter, 2019; Lac, 2021; Nojan, 2020).

Further consideration and next steps resulting from this discussion encourages Ontario, Canada's K-12 education stakeholders to consider an iteration of their assessment document that reflects empathy, metacognition, and critical consciousness. A potential reconsideration of the role these skills play in assessment and learning might help inform a new framework for assessment and evaluation in Ontario Canada's K-12 schools. By inviting students, their families, and educators as partners in the assessment process, educators may encourage learners to think about their own learning strengths and needs while articulating and sharing their journey. An understanding and empathetic community can support these highly reflective environments where educators, students, and their families can work together to share their thinking metacognitively and reflect on growth and identify future goals collaboratively through a critically conscious lens that considers the lived experiences of their learning community.

References

Assessment Reform Group. (2002). Assessment for learning: 10 principles.

Balkaya, S., & Akkucuk, U. (2021). Adoption and use of learning management systems in education: The role of playfulness and self-management. *Sustainability*, Vol. 13, No. 3, 1127.

Barber, W. (2020). Building creative critical online learning communities through digital moments. *Electronic Journal of e-Learning*, Vol. 18, No. 5, pp. 387-396.

Barell, J. (2010). Problem-based learning: The foundation for 21st century skills. *21st century skills: Rethinking how students learn*, pp. 175-199.

Berkovich, I. (2020). Conceptualisations of empathy in K-12 teaching: a review of empirical research. *Educational Review (Birmingham)*, Vol. 72, No. 5, pp. 547–566. https://doi.org/10.1080/00131911.2018.1530196

Bialystok, L., & Kukar, P. (2018). Authenticity and empathy in education. *Theory and Research in Education*, Vol. 16, No. 1, pp. 23–39. https://doi.org/10.1177/1477878517746647

Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability* (formerly: Journal of Personnel Evaluation in Education), Vol. 21, No. 1, pp. 5-31.

Blackwelder, A., (2020). What going gradeless taught me about doing the "actual work". In S. D Blum (Eds), *Ungrading: Why rating students undermines learning (And what to do instead)*, pp. 42-52. West Virginia University Press.

Blake, N., & Masschelein, J. (2003). Critical theory and critical pedagogy. *The Blackwell guide to the philosophy of education*, pp. 38-56.

Blasco, P. G., & Moreto, G. (2012). Teaching empathy through movies: reaching Learners' affective domain in medical education. *Journal of Education and Learning*, Vol. 1, No. 1, p. 22.

Blayone, T. J., vanOostveen, R., Barber, W., DiGiuseppe, M., & Childs, E. (2017). Democratizing digital learning: theorizing the fully online learning community model. *International Journal of Educational Technology in Higher Education*, Vol. 14, No. 1, pp. 1-16.

Blum, S. D., (2020). *Ungrading: Why rating students undermines learning (And what to do instead)*. West Virginia University Press.

Boske, C., Osanloo, A., & Newcomb, W. S. (2017). Exploring empathy to promote social justice leadership in schools. *Journal of School Leadership*, Vol 27, No. 3, pp. 361-391.

Bourke, R., & Mentis, M. (2014). An assessment framework for inclusive education: integrating assessment approaches. *Assessment in Education : Principles, Policy & Practice*, Vol. 21, *No.* 4, pp. 384–397. https://doi.org/10.1080/0969594X.2014.888332

Boud, D., & Falchikov, N. (Eds.). (2007). *Rethinking assessment in higher education: Learning for the longer term*. Routledge.

Brett, A., Smith, M., Price, E., & Huitt, W. (2003). Overview of the affective domain. *Educational Psychology Interactive*, pp. 1-21.

Brookfield, S. (1998). Critically reflective practice. *Journal of Continuing Education in the Health Professions*, Vol. 18, No. 4, pp. 197-205.

Brown, P., Roediger, H., McDaniel, M., & Stick, M. I. (2014). The science of successful learning. Cambridge, MA.

C21 Canada (Canadians for 21st Century Learning and Innovation). (2012). Shifting minds: A 21st century vision of public education for Canada. Retrieved from: www.c21canada.org/wp-content/uploads/2012/11/Shifting-MindsRevised.pdf.

Carroll, M., & Mcbain, L. (2021). Where empathy meets learning: Exploring design abilities in K-12 classrooms. *Voices From the Middle*, Vol. 29, No. 1, pp. 14-9.

Casale, C., Thomas, C. A., & Simmons, T. M. (2018). Developing empathetic learners. *Journal of Thought*, Vol. 52, No. 3-4, pp. 3–18.

Chapman, T., Jones, M., Stephens, R., Lopez, D., Rogers, K. D., & Crawford, J. (2020). A necessary pairing: Using academic outcomes and critical consciousness to dismantle curriculum as the property of whiteness in K-12 ethnic studies. *Equity & Excellence in Education*, Vol. 53, No. 4, 569–582. https://doi.org/10.1080/10665684.2020.1791767

Chiaravalli, A., (2020). Grades stifle student learning. Can we learn to teach without grades? In S. D Blum (Eds), *Ungrading: Why rating students undermines learning (And what to do instead)*, pp. 82-88. West Virginia University Press.

Chu, G., (2020). The Point-less classroom. In S. D Blum (Eds), *Ungrading: Why rating students undermines learning (And what to do instead)*, pp. 161-170. West Virginia University Press.

Conrad, J. (2020). Navigating identity as a controversial issue: One teacher's disclosure for critical empathic reasoning. *Theory and Research in Social Education*, Vol. 48, No. 2, pp. 211–243. https://doi.org/10.1080/00933104.2019.1679687

Cox, T. L., Malone, M. E., & Winke, P. (2018). Future directions in assessment: Influences of standards and implications for language learning. *Foreign Language Annals*, Vol. 51, No.1, 104–115. https://doi.org/10.1111/flan.12326

Crooks, A. (1933). Marks and marking systems: A digest. *The Journal of Educational Research*, Vol. 27, No. 4, pp. 259-272. Retrieved June 13, 2021, from http://www.jstor.org/spp.table/27525788

Cumming, J. J. , & Maxwell, G. S. (1999). Contextualising authentic assessment. *Assessment in Education: Principles, Policy & Practice*, Vol. 6, No. 2, pp. 177-194.

El-Amin, A., Seider, S., Graves, D., Tamerat, J., Clark, S., Soutter, M., Johannsen, J., & Malhotra, S. (2017). *Critical consciousness: A key to student achievement*. kappanonline.org. Retrieved January 21, 2022, from https://kappanonline.org/critical-consciousness-key-student-achievement/

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American Psychologist*, Vol. 34, No. 10, 906.

Freire, P. (2005) *Education for critical consciousness.* New York: Continuum International Publishing Group.

Freire, P. (2020). Pedagogy of the oppressed. In *Toward a sociology of education*, pp. 374-386, Routledge.

Fu, H., Hopper, T., & Sanford, K. (2018). New BC curriculum and communicating student learning in an age of assessment for learning. *Alberta Journal of Educational Research*, Vol. 64, No. 3, 264-286.

Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Educatio*n, Vol. 13, No. 1-2, pp. 5-9.

Giammarco, M., Higham, S., & McKean, M. (2020). The future is social and emotional: evolving skills needs in the 21st century. *The Conference Board of Canada.* Retrieved January 13, 2022, from https://www.conferenceboard.ca/temp/977ecc82-0284-49c5-9bac-514adbd82e25/24357_10628_FSC_SES_Impact_Paper_EN.pdf

Goleman. (2005). *Emotional intelligence* (10th anniversary ed.). Bantam Books.

Gray, A. (2016). *The 10 skills you need to thrive in the Fourth Industrial Revolution*. World Economic Forum. Retrieved January 14, 2022, from https://www.weforum.org/agenda/2016/01/the-10-skills-you-need-to-thrive-in-the-fourth-industrial-revolution/

Hartman, R., Johnston, E. & Hill, M. (2017). Empathetic design: A sustainable approach to school change. *Discourse and Communication for Sustainable Education*, Vol. 8, No. 2, pp. 38-56. https://doi.org/10.1515/dcse-2017-0014

Hechter, R. (2019). The giant, the wintermaker, and the hunter: contextual ethnoastronomy towards cultivating empathy. *Physics Education*, Vol. 55, No. 1, pp. 15025–. https://doi.org/10.1088/1361-6552/ab537d

Herrington, J., & Herrington, A. (1998). Authentic assessment and multimedia: How university students respond to a model of authentic assessment. *Higher Education Research & Development*, Vol. 17, No. 3, pp. 305-322.

Herrington, J., Reeves, T. C., & Oliver, R. (2014). Authentic learning environments. Handbook of research on educational communications and technology, pp. 401-412.

Holt, J. (2004). *Instead of education: Ways to help people do things better*. Sentient Publications.

hooks, b. (1994). *Teaching to transgress : Education as the practice of freedom*. Routledge.

Immordino-Yang, M. H., Darling-Hammond, L., & Krone, C. (2018). The brain basis for integrated social, emotional, and academic development: How emotions and social relationships drive learning. Aspen Institute.

Immordino-Yang, M. H., Darling-Hammond, L., & Krone, C. R. (2019). Nurturing nature: How brain development is inherently social and emotional, and what this means for education. *Educational Psychologist*, Vol. 54, No. 3, pp. 185-204.

Kohn, A. (1994). Grading - The issue is not how but why. *Educational Leadership*, *Vol.* 2, pp. 38–41.

Kohn, A. (1999). *The schools our children deserve: moving beyond traditional classrooms and "tougher standards"*. Houghton Mifflin Harcourt.

Kohn, A., (2020). Foreword. In S. D Blum (Eds), *Ungrading: Why rating students undermines learning (And what to do instead)* (pp. xiii-xx). West Virginia University Press.

Lac, V. (2021). "Now I know that meritocracy and the American dream are myths": employing critical hope in a teacher pipeline program serving minoritized high school students. *International Journal of Qualitative Studies in Education*, Vol. 34, No. 5, pp. 447–463. https://doi.org/10.1080/09518398.2020.1771458

Lee, J., Lee, Y., & Kim, M. H. (2018). Effects of empathy-based learning in elementary social studies. *The Asia-Pacific Education Researcher*, Vol. 27, No. 6, pp. 509–521. https://doi.org/10.1007/s40299-018-0413-2

Luettchau, K. (2021). Choice and reflection: How I've used personalized learning to engage students and provide equity during a pandemic. *English Leadership Quarterly*, Vol. 43, No. 3, pp. 2–6.

Marzano, R. J., & Heflebower, T. (2011). *Teaching & assessing 21st century skills*. Solution Tree Press.

McDonald, B. (2012). Portfolio assessment: Direct from the classroom. *Assessment & Evaluation in Higher Education*, Vol. 37, No. 3, pp. 335-347.

Nojan, S. (2020). Why ethnic studies? Building critical consciousness among middle school students. *Middle School Journal*, Vol. 51, No. 2, pp. 25–35. https://doi.org/10.1080/00940771.2019.1709259

O'Connor, J. S., & Lessing, A. D. (2017). What we talk about when we don't talk about grades. *Schools (Chicago, Ill.)*, Vol. 14, No. 2, 303–318. https://doi.org/10.1086/693793

Ontario Ministry of Education. (2010). *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools*. Retrieved from http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf

Oyedotun, T. D. (2020). Sudden change of pedagogy in education driven by COVID-19: Perspectives and evaluation from a developing country. *Research in Globalization*, *2*, 100029. https://doi.org/10.1016/j.resglo.2020.100029

Reeves, T. C., Herrington, J., & Oliver, R. (2002). Authentic activities and online learning. *Quality Conversations: Research and Development in Higher Education*, Vol. *25*, pp. 562-567.

Reynolds, B. G. (2010). Effect of digital portfolio assessment on mathematics attitudes and self-perceptions of sixth- through eighth-grade students (Order No. 3413062). Available from ProQuest Dissertations & Theses Global. (1370975236). http://search.proquest.com.uproxy.library.dc-uoit.ca/dissertations-theses/effect-digital-portfolio-assessment-on/docview/1370975236/se-2?accountid=14694

Sackstein, S. (2015). *Hacking assessment: 10 ways to go gradeless in a traditional grades school*. Cleveland, OH: X10 (Times 10) Publications.

Schwab, K. (2018). The global competitiveness report 2018. In *World Economic Forum* Vol. 671.

Stommel, J., (2020). How to ungrade. In S. D Blum (Eds), *Ungrading: Why rating students undermines learning (And what to do instead)* (pp. 25-41). West Virginia University Press.

Swaffield, S. (2011). Getting to the heart of authentic assessment for learning. *Assessment in Education: Principles, Policy & Practice*, Vol. 18, No. 4, pp. 433-449.

Taiwo, S. O., & Vezi-Magigaba, M. F. (2021). Human capital perspective of previous industrial revolutions: Review in support of 4IR and its possible impacts. *Multicultural Education*, Vol. 7, No. 8.

Timmis, S., Broadfoot, P., Sutherland, R., & Oldfield, A. (2016). Rethinking assessment in a digital age: Opportunities, challenges and risks. *British Educational Research Journal*, Vol. 42, No. 3, pp. 454-476.

van Oostveen, R., DiGiuseppe, M., Barber, W., Blayone, T., & Childs, E. (2016, June). New conceptions for digital technology sandboxes: Developing a Fully Online Learning Communities (FOLC) model. In *EdMedia+ Innovate Learning*, pp. 665-673. Association for the Advancement of Computing in Education (AACE).

Veenman, M. V., Van Hout-Wolters, B. H., & Afflerbach, P. (2006). Metacognition and learning: Conceptual and methodological considerations. *Metacognition and learning*, Vol. 1, No. 1, 3-14.

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning and schooling in the digital networked world of the 21st century. *Journal of computer assisted learning*, Vol. 29, No. 5, pp. 403-413.

Vu, T., & Dall'Alba, G. (2014). Authentic assessment for student learning: An ontological conceptualisation. *Educational Philosophy and Theory*, Vol. 46, No. 7, pp. 778–791. https://doi.org/10.1080/00131857.2013.795110

Waddell, K., Gauvin, F., & Mattison, C. (2018). Rapid synthesis: Fostering K-12 students' global competencies. Retrieved January 13, 2022, from https://macsphere.mcmaster.ca/handle/11375/23794

Western and Northern Canadian Protocol for Collaboration in Education. (2006). *Rethinking classroom assessment with purpose in mind.* Winnipeg: Manitoba Education, Citizenship and Youth.

World Economic Forum (2016). The 10 skills you need to thrive in the Fourth Industrial Revolution, Retrieved from http://www.weforum.org/agenda/2016/01/the-10-skills-you-need-to-thrive-in-the-fourth-industrial-revolution.

Lessons Learnt From The Home Office: An Autoethnographic Case Study

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Abstract: The Corona pandemic has certainly acted as a catalyst for technology enabled and technology enhanced learning. In this paper technology enabled learning is defined as learning activities that are supported and made possible by technology, while technology enhanced learning refers to learning activities where technology has improved the quality. To what degree, and how teaching and learning activities and meetings have been transformed depends on the actual educational orchestration before the pandemic. This case story is based on experiences from courses and collaborations at a department of computer and system science. The question that guided this study was: "What are the lessons learnt from online activities at the home office during the pandemic?". This study was carried out as an autoethnographic case study with five case units: 1) A programming course 2) A course for Bachelor's thesis writing, 3) A course for system development by internship, and 4) Staff meetings and 5) Research collaborations. Results indicate that at a department where technology enabled blended synchronous learning was the standard mode already before the pandemic, the forced changes have not been that drastic. However, the course with internship and workplace learning has really suffered. The course where students have their Bachelor's thesis supervision has been much alike, while the other units show improvements that could be classified as technology enhancement. Ensemble programming online has worked very well, staff meetings have been more focused than in face-to-face mode, and the research collaborations have been efficient and with a high number of publications. Research methods seems to have changed with more literature reviews, more of email interviews and more of focus group interviews in video conference systems. The part of research that has suffered is the one with conferences, and as an example, networking at a virtual conference has been rather poor. Finally, many home offices seem to survive the pandemic due to the high and high-quality delivery from home, with the known risk of distance workers becoming workaholics.

Keywords: technology enabled learning, technology enhanced learning, educational tools, corona pandemic, autoethnographic case study

1. Introduction

Many research studies have reported on how the Corona pandemic has been a driving force for a transition to technology enabled and technology enhanced learning (Al-Ataby, A., 2020; Mozelius, 2020; Paige, 2021; Enbeyle, Ogunmola and Amin. 2022). This study defines technology enabled learning as teaching and learning activities that are supported and made possible by technology. To be compared to technology enhanced learning activities with a definition of technology that enhances and improves the learning quality. How much of transition and the actual instructional design show huge variations show huge variations due to the pre-pandemic curricula design (Crawford et al, 2020; Mozelius, 2020).

This paper has been written with an autoethnographic approach based on my experiences during the Corona pandemic. Experiences that have been compared to my pre-pandemic experiences with 20 years of teaching and research in computer and system science at various universities. The aim of the study is to analyse and discuss which best practices from the home office that are important to keep in the post-pandemic new normality.

2. Method

The autoethnographic approach to research and writing strives to systematically describe and analyse (graphy) personal experience (auto), with the aim of understanding cultural experience (ethno) (Holman Jones, 2005). This approach challenges traditional research, but at the same time opens up a new way of exploring personally experienced phenomena (Spry, 2001), In the genre of autoethnographies, researchers seek to "produce aesthetic and evocative thick descriptions of personal and interpersonal experience" (Ellis, Adams & Bochner, 2011, p. 277). Moreover, autoethnography could be conducted as a case study involving reflective, analytical and personal account of practice, that strives to find relevant aspects of professional practice. (Kinchin & Francis, 2017). This study was conducted as an autoethnographic case study with five case study units with data gathered from my personal and interpersonal experiences during the Corona pandemic. The five case units in this study were: 1) A programming course 2) A course for Bachelor's thesis writing, 3) A course for system development by

internship, and 4) Staff meetings and 5) Research collaborations. Each of these units are described one by one in separate sections here below.

3. A programming course

The programming course is a contract course by the Swedish National Agency for Education, for professional development of secondary school teachers in mathematics and technology. Course design was developed with the assumption that programming courses for secondary school teachers should have different requirements than the traditional higher education programming course. One distinction is that there ought to be a higher emphasis on didactic concepts that can be reused in the participants' own teaching and learning activities (Mozelius, 2018). This course was originally a 7,5 ECTS course, divided into five main sections: 1) Programming in school, why, what and how? 2) The fundamental building block of programming 3) Didactics for Technology and Mathematics 4) Didactics for programming education, and 5) Project work.

With the principle in work-integrated learning of facilitating for full time working professionals, the course has always been given on 25% study pace. Before the pandemic four one day onsite meetings were combined with online interactions and asynchronous activities in the virtual learning environment Moodle. After three completed course batches, this course in 2020 restructured to encompass 5 ECTS, and to have a stronger focus on textual programming. Compared to the while previous course versions that comprised multiple types programming and of programming tools. (Mozelius & Humble, 2022) To respond to the Corona pandemic, the new version of the course was restructured, from an onsite and online hybrid, to a fully online course where the videoconferencing system Zoom has replaced the earlier classroom meetings.

This shift has introduced new challenges for the course, one is the individual support teachers with less general technical skills, another is how to provide active group collaboration online. At the same time the shift to online mode only has created new flexible opportunities. In the first version of the course almost all participants were from the the Mid-Sweden region, while the redesigned online version could open up for participation from all over the Swedish nation. This has been beneficial for both for the economical sustainability, and for the course participants exchange of experience and best practices (Humble & Mozelius, 2021). Finally, and the most positive experiences group work has worked better online than earlier onsite, and the pass rates have been at the same level and sometimes higher. Problem-solving and ensemble programming activities have appeared to have a better focus and more intense collaboration given in Zoom break-out rooms, compared to the earlier course batches working with similar tasks in active learning classrooms onsite. Finally, and enjoyable, the last course evaluations have shown a higher participant satisfaction than for the earlier courses given in blended mode.

4. A course for Bachelor's thesis writing

Not much has changed in this course due to the pandemic, but there are new course literature and some extra seminars that have made a positive impact. Like before the pandemic there has been a nationwide spread of students where the vast majority take the course by distance. Looking at the last five years the average outcome is better for online students than for onsite students. The main explanation here is that students taking the course in online mode are more mature, have a better general study technique, and a higher motivation. As pointed out by (Bastalich 2015,) thesis supervision involves the delicate balance between controlling student and not blocking the idea of a thesis as a piece of independent work. This is in this course orchestrated with strict deadlines, regular online seminars, and with the supervisor taking the role of a guide rather than of a controller. What is essential are the synchronous facilitating seminars, and as highlighted by Gray and Crosta (2019), online thesis supervision needs to develop its own rules and conventions. Their recommendations of an establishment of reciprocal expectations and multi-modal feedback were created for doctoral students, but most of the brought-up ideas seems to make sense for undergraduates as well.

What I find essential are that the supervisor should be able to "to communicate effectively through the online medium", "to acquire resources generally as well as pertinent online resources", and to have "the vision and experience to see ahead, particularly in respect of potential online difficulties and strains" (Gray & Crosta, 2019, p.14). The issues of communication, guiding and to provide adequate resources are basically the same online or onsite, but the possibility of instantly sending hyperlinks to resources at online seminars is an advantage. Another thing that has worked out well online are multi-supervisor seminars for smaller groups of students, where supervisors can give various aspects of research and academic writing. Students have appreciated the supervisor dialogue where students can participate and at any time stop for questions. Moreover, the multi-

supervisor seminars included shorter mini-lectures and workshops on research methods. This was combined with single-supervisor seminars for more detailed facilitation on concrete details in the theses. For the final seminars in the last some students defended their theses on campus when the pandemic restrictions were repealed. However, most students and supervisors participated online at the final seminar as well. At the time of writing the grades are not yet set for this years Bachelor's theses, but my impression is that there are other more important success factors than the question of online or onsite. On the other hand, students living far away from the university, and students that have to work during the thesis writing got an improved supervision online during the pandemic (Chandrasena Premawardhena, 2021).

5. A course for system development by internship

Internship by distance could be seen as a contradiction, but in the field of information technology there are some successful attempts. As claimed by AlGhamdi (2022, p.329), with the appropriate online platforms and tools, *"A virtual internship today might be good preparation for the virtual/remote work of tomorrow"*. This idea could open up opportunities in the future, not least for programmes on computer and system science, but this course was designed and announced for onsite internships. During the first summer with pandemic restrictions four internships were carried out, and mainly online, but many companies withdraw their internships. On the second summer during the pandemic there were only two companies that remained, and the students were shifted two another similar course at the university's other campus.

To give a course with four teachers and two students is not a good idea, but hopefully a new course can be given next summer with a substantially larger student group. From the university side this course could easily be given online with a mix of synchronous and asynchronous activities. For companies and organisations, the shift was more problematic and there were also security restrictions to consider. As an example, some companies did not allow online activities in the Zoom video conferencing system. Future course versions will probably not be completely in online mode, but the pandemic has resulted in a richer toolbox for online collaboration that could be used for internships as well. With technology-enabled and more flexible internships companies and organisations

6. Staff meetings

The response to the pandemic has not only been about moving content online, and there has also emerged a new participatory culture among staff (Justis et al., 2020). To move staff meetings online is an idea as old as the appearance of the first video conference systems, motivated by the arguments of low cost and meeting efficiency (Raitt, 1989; Saarinen, 1996). At the same time, it has been reported that some persons get tired at online meetings and experience so called video conferencing fatigue. This might be explained by the fact that the video conferencing tools that we use today, take away non-verbal cues. When a person is visible online, your brain tries to compute the non-verbal language. When this is impossible, the brain works harder trying to achieve the impossible which could result in meeting participants feeling unnecessarily tired. The cure for online meeting fatigue, might be to build our future online meeting systems as mixed reality environments. (Wall et al., 2022)

My personal experience is that staff meetings have become more focused when shifted, compared both to face-to-face mode, and to blended synchronous mode. The agenda is followed more strictly and that the meeting time sometimes comes down to one third of the earlier meeting lengths. This could partly be explained with persons, who in face-to-face mode make lengthy comments on non-agenda issues, appears to be less talkative and less egoistic online. As reported by Richter (2020), online meetings have been perceived less political and more focussed on agenda and content. Moreover, the new online meeting culture has "led people to radically question existing face-to-face rituals like the display of power during physical meetings " (Richter, 2020, p. 3). At the university where I am working the future meeting forms are under discussion, but at some other universities the choice is to keep staff meetings in online mode.

7. Research collaborations

Online research collaborations comprise more that online meetings, and issues such as how to share data (Vejvoda, Luo & Berg, 2021), and how to analyse data collaboratively online (Schulz & Kleijweg, 2022). In one research project I have been working in, the research design could be classified as traditional, with expected field observations and face-to-face activities. Here the outcome was lower than expected with the pandemic as a negative game changer, and without any Plan B. Regarding the projects where I work with research on various aspects of technology enhanced learning the adaptation was easier with technology enabled research as the

answer. Data collection had also to be technology enabled with interviews and focus groups shifted to online mode. Another difference in research methods is the high number of literature studies conducted during the pandemic. Furthermore, the overshadowing experience is the high number of studies on the pandemic during the pandemic, not only on medical aspects of Corona/Covid-19.

Looking at the outcomes of research during the pandemic, research collaborations have been efficient and that they have resulted in a high number of publications. In a brief summary, I have seven journal articles, eight book chapters, and 22 conference papers published after the outbreak of Covid-19 in early March 2020. It can be argued that early March 2020 is not the correct start time for the pandemic, but for me it was a strong sensation of a pandemic immediately changing our research habits during those days. I was presenting two papers at a conference in Spain where several presenters did not show up, and that new hygienical routines were introduced in the middle of the session where I presented one of my papers. The conference ended without the expected networking activities, and with a flight back home to close to two years of quarantine in the home office. Virtual conferences without travel and accommodation costs have enabled to present more research papers than earlier, but sometimes with limited interaction and with poor networking opportunities. At the same time as virtual conferences have been beneficial for the environment they have not always been enjoyable.

8. Discussion

As recently brought up at a workshop on Phenomenology at a conference on networked learning (NLC, 2022), a reported pandemic phenomenon is about students attending online activities in pyjamas. This could of course be discouraging for both teachers and other course participants, and to quote the song by Frank Zappa:

"Pyjama people! Pyjama people, people! They sure do make you sleepy"

On the other hand, and as commented by a researcher on didactics at the same workshop "It is also a recurring phenomenon with students carrying 'mental pyjamas' at onsite activities". Instead of having prejudices about students automatically being active in onsite activities, and the opposite online, I find it more interesting to strive for 'onconsious' student. With the same definition of onconscious as when it is used as a slang word: 'being in an attentive state of mind'. Not necessarily in a state of flow with hyperfocus and complete immersiveness, but awake and attentive.

There is recipe for always having onconcious students in either onsite or online activities, but active learning and quality course content are the best guarantees. If activities are perceived as relevant the amount of onconsiousness will increase, independent on the communication mode, and with the same effect on all the described case units. As highlighted in many university courses on pedagogy, every student group will always be heterogeneous, and with variations in study preferences. The same variations have also been observed at staff meetings and in research groups as well.

A suggested lens for analysing variations in personality traits is the five-factor model of personality, that also has been referred to as FFM, The Big Five Model, or OCEAN (Costa & McCrae, 1992; Jackson & Soto, 2015). The last acronym is built around the first letters in the five factors or personality traits. Openness to experience, Conscientiousness, Extraversion, Agreeableness and Neuroticism. All these factors have their corresponding counterparts, two examples are Extraversion – Intraversion, and that Neuroticism has a polar opposite in Emotional Stability (Jackson & Soto, 2015). Personality traits should not necessarily be seen as belonging to any of the two polar opposites, but rather as somewhere in a continuum there in-between. Applied to university teachers and researchers, the most positive attitudes towards online collaboration in teaching and research, would probably be found amongst individuals closer to the poles of introversion and conscientiousness. These two traits combined with a bit of agreeableness would probably form a good foundation for onconciousness in online collaborations.

As suggested in Mozelius (2020), a suitable mix of personality traits for studying and working by distance seems to be medium openness, medium to high conscientiousness, a low or medium degree of extraversion, medium to high agreeableness and a low degree of neuroticism. Considering the heterogeneity in student groups asynchronous learning activities must be combined with synchronous ones. Two lessons learnt during the pandemic are: 1) Well-planned synchronous learning can work well and sometimes better online, and 2) The combination of synchronous and asynchronous teaching and learning is stronger than just one of them. It can be argued that 2) was a known fact even before the pandemic, but that teachers have found new ways of mixing them during the pandemic. The post-pandemic new normality will probably be *HyFlex*, where hybridity should

meet flexibility in a blend of onsite and online activities based on the same learning objects for all students. A HyFlex design that should provide participants a choice of modality to attend activities, with equivalent activities in the offered modalities (Beatty, 2019; Miller, Sellnow & Strawser, 2021). Finally, many companies and organisations have been gaining trust in that the daily work continues even when their employees are physically distant and work in online environments (Richter, 2020). An example of this is, twitter.com that have announced that their employees would be allowed to work from home forever (Paul, 2020). In a state of permanent distance work, persons with a tendency to workaholism, have easier to become addicted when connected to work through technology, and that an authoritarian leadership style in distance work created more stress, and increased the risk for workaholism. (Spagnoli et al. 2020).

9. Conclusion

The conclusion is that for me, who works at a department where technology enabled blended synchronous learning was frequently used already before the pandemic, the shift to online activities had not been that stressful and drastic. However, for several of the case units the need for new online forms have been obvious and urgent, and at the same time resulting in new creative and efficient online activities. The recommendation is that, under the umbrella of HyFlex, the lessons learnt should be gathered in new combinations of synchronous and asynchronous activities, with the aim of active learning and unconsciousness. Due to the high-quality delivery from home many home offices and new collaboration forms would probably survive the pandemic. The negative aspect is the distance workers' risk of becoming workaholics, otherwise distance working has been reported to have a positive impact on well-being, and that many distance workers want to continue to work by distance (Ärilä, 2022).

10. Future research

A next interesting step would be to develop the ideas that were presented in this autoethnographic attempt, with findings from a systematic literature on the HyFlex concept.

References

Al-Ataby, A., 2020. Technology-enhanced learning and teaching in COVID-19 era: Challenges and recommendations. *International Journal for Innovation Education and Research, 8*(10), pp.317-331.

Ärilä, N., 2022. The impact of remote work on employees' well-being: how well-being is experienced in remote work and how it an be promoted in an accounting firm.

AlGhamdi, R.A., 2022. Virtual internship during the COVID-19 pandemic: exploring IT students satisfaction. *Education+ Training*.

Bastalich, W., 2017. Content and context in knowledge production: a critical review of doctoral supervision literature. *Studies in Higher Education, 42*(7), pp.1145-1157.

Beatty, B.J., 2019. Teaching a Hybrid-Flexible Course. *Hybrid-Flexible Course Design*.

Chandrasena Premawardhena, N., 2021. Remote Supervision: A Boost for Graduate Students. In *International Conference on Interactive Collaborative Learning* (pp. 634-644). Springer, Cham.

Costa Jr, P.T. and McCrae, R.R., 1992. Four ways five factors are basic. *Personality and individual differences*, *13*(6), pp.653-665.

Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Burton, R., Magni, P. and Lam, S., 2020. COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching, 3*(1), pp.1-20.

Ellis, C., Adams, T.E. and Bochner, A.P., 2011. Autoethnography: an overview. *Historical social research/Historische sozialforschung*, pp.273-290.

Enbeyle, W., Ogunmola, G.A. and Amin, R., 2022. COVID-19: A Catalyst for Technology-Enhanced Learning (TEL)–An Empirical Validation of the Efficacy of Learn From Home in Higher Education Students*. International Journal of Virtual and Personal Learning Environments (IJVPLE), 12*(1), pp.1-15.

Gray, M.A. and Crosta, L., 2019. New perspectives in online doctoral supervision: a systematic literature review. Studies in Continuing Education, 41(2), pp.173-190.Holman Jones, Stacy. 2005.

Autoethnography: Making the personal political. In *Handbook of qualitative research*, ed. Norman K. Denzin and Yvonna S. Lincoln, 763-791. Thousand Oaks, CA: Sage.

Humble, N., and Mozelius, P. (2021). Enhancing Pedagogy to Andragogy in the Redesign of Teacher Training Courses on Programming. In *European Conference on e-Learning 2021 (ECEL 2021)* (pp. 210-217). Academic Conferences and Publishing International Limited.

Jackson, J.J. and Soto, C.J., 2015. Five-factor model of personality. *Oxford bibliographies in psychology.*

Justis, N., Litts, B.K., Reina, L. and Rhodes, S., 2020. Cultivating staff culture online: How Edith Bowen Laboratory School responded to COVID-19. *Information and Learning Sciences*.

Kinchin, I.M. and Francis, R.A., 2017. Mapping pedagogic frailty in geography education: A framed autoethnographic case study. *Journal of Geography in Higher Education, 41*(1), pp.56-74.

Miller, A.N., Sellnow, D.D. and Strawser, M.G., 2021. Pandemic pedagogy challenges and opportunities: Instruction communication in remote, HyFlex, and BlendFlex courses. *Communication Education*, *70*(2), pp.202-204.

Mozelius, P. 2018. Teaching The Teachers To Teach Programming: On Course Design and Didactic Concepts. In *11th annual International Conference of Education, Research and Innovation* (Vol. 11, pp. 8031-8037). The International Academy of Technology, Education and Development.

Mozelius, P., 2020. Post Corona Adapted Blended Learning. In *Responding to Covid-19: The University of the Future*: / [ed] Dan Remenyi, Ken A Grant and Shawren Singh, Reading, UK: ACIL

Mozelius, P. and Humble, N., 2022. Programming in K-12 Mathematics–A two-step rocket. In *INTED 2022, 16th annual International Technology, Education and Development Conference, Valencia, Spain, [DIGITAL], March 7-8, 2022.* (Vol. 16, pp. 2389-2397). IATED Academy.

NLC. 2022. The Thirteenth International Conference on Networked Learning, Sundsvall, Sweden. (Retrieved 28/05/2022) https://www.networkedlearning.aau.dk/NLC2022/

Paige, J.T., 2021. What's in a name? Simulation and technology enhanced learning uses and opportunities in the era of COVID-19. *BMJ Simulation & Technology Enhanced Learning, 7*(1), pp.1-2.

Paul, K. 2020. *"Twitter announces employees will be allowed to work from home forever"* The Guardian (Accessed 31/05/2022) from: https://www.theguardian.com/technology/2020/may/12/twitter-coronavirus-covid19-work-from-home

Raitt, D., 1989. The evolution and development of the International Online Information meetings. *Online Review*.

Richter, A., 2020. Locked-down digital work. *International Journal of Information Management*, *55*.

Saarinen, L., 1996. NetEc and economics information on the internet. *New Review of Information Networking*, *2*(1), pp.229-32.

Schulz, D. and Kleijweg, A., 2022. Cocreating Online Research Methods During COVID-19: Using Teams and Padlet to Cocreate a Codebook for Online Content Analysis.

Spagnoli, P., Molino, M., Molinaro, D., Giancaspro, M.L., Manuti, A. and Ghislieri, C., 2020. Workaholism and technostress during the COVID-19 emergency: The crucial role of the leaders on remote working. *Frontiers in psychology*, *11*, p.3714.

Spry, Tami. 2001. Performing autoethnography: An embodied methodological praxis*. Qualitative Inquiry 1* (6): 706-732.

Vejvoda, B., Luo, R. and Berg, S., 2021. Virtualization of Research Data Services during the COVID-19 Pandemic as an Opportunity to Enhance Research Data Support. *International Journal of Librarianship*, *6*(2), pp.49-62.

Wall, J., Poobalasingam, V., Sharif, S., Moniri, M., Glackin, C. and Cannings, N., 2022. A Mixed Reality Approach for dealing with the Video Fatigue of Online Meetings. In *7th International XR Conference*.

Educational Development: Challenges, Opportunities, Tools and Techniques

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Abstract: As pointed out by many researchers, the ongoing pandemic has been a catalyst for educational development. With the increasing need for reskilling and lifelong learning, the current model of technology-enhanced learning needs updating, and so does also the university programmes for bachelor's and master's students. This study is based on an online brainstorming session and submitted development plans in the HEaD (Higher Education and Digitalisation) project, a five-year initiative for technology-enhanced educational development. HEaD is a development project aimed at supporting university teachers to work with research and development in the field of technology-enhanced and lifelong learning. As the research strategy, an action research approach was used, with the purpose of improving the educational process where authors also have the roles of teachers and facilitators. The aim of the study is to describe and discuss pilot project members' perceptions of challenges, opportunities, tools and techniques in higher education development. Data gathered from workshop discussion summaries and project plans were thematically analysed. Ideas from the workshop sessions were written down and saved with the use of the digital notice board Padlet. Results from the thematic analysis have been grouped into the four predefined categories of challenges, opportunities, tools and techniques. Findings show that course participants and project members have interesting ideas that have the potential to reinforce the current educational model at the university. Several tools and techniques that could support synchronous as well as asynchronous online learning will be tested and evaluated. Both the workshop summaries and the project plans show a high degree of creativity, but on the other hand, the method descriptions were scarce and would need improvement. The conclusion is that the project has had a good start if seen as development, but that there is a need for improvement and more input to achieve the intended core idea of research and development.

Keywords: educational development, pedagogical development, technology-enhanced learning, teaching and learning tools, pedagogical action research

1. Introduction

For many universities the Corona/Covid-19 pandemic has acted as a strong catalyst for educational development (Terenko & Ogienko, 2020; Tolks, Kuhn & Kaap-Fröhlich, 2020). The pandemic has clearly pointed out the need for new tools and new ideas for instructional design in higher education that is increasingly technology-enhanced (Agnoletto & Queiroz, 2020; Mozelius, 2020). At the Mid Sweden University, there is an ongoing discussion on the future role of higher education and lifelong learning has been combined with the ambition of being a leading university in the area of technology-enhanced learning. In this context the term technology enhanced learning is used with the idea presented in (Kirkwood & Price, 2014), there should not only be an increased use of technology, but also an improvement of teaching and learning practices. Moreover, the ongoing global shift to a knowledge society further increases the need for investment in human resources, and a flexible lifelong professional development for the next generation of the workforce (Bridgstock, 2017; Baporikar, 2016).

Considering lifelong learning, this is an old phenomenon that could be traced back to at least Ancient Greece and Plato's 'The Republic', with discussions on continuous learning to improve leadership (Williamson, 2008). Still makes sense, but lifelong learning today should better have a less elitist perspective and a more inclusive outline. The 17th-century Czech educationalist and philosopher Johann Amos Comenius advocated the modern idea of lifelong learning for all. These two aspects of lifelong learning were later combined by the French Enlightenment mathematician and philosopher Nicolas de Condorcet who claimed that lifelong learning should involve both professional and personal development (Jaldemark, 2020). In the discussion on lifelong learning Billet (2010) highlighted the importance of a distinction between lifelong education and lifelong learning, but in contemporary educational development the strive could be to combine the two aspects. Well-designed and challenging professional development might also lead to personal development.

To support the ambition of being a leading university in the field of technology-enhanced learning, the Higher Education and Digitalisation (HEaD) project was started. A five-year-long initiative, with the purpose of strengthening teachers' competence in the field of technology-enhanced and lifelong learning. The first pilot batch that this study is based on consists of four projects that all have a focus on educational development. The Vice-Chancellor and the HEaD team have high expectations, but what are the project members' perceptions?

The aim of the study is to describe and discuss pilot project members' perceptions of challenges, opportunities, tools and techniques in higher education development.

2. Extended background

2.1 The relationship between higher education and lifelong learning

Higher education and lifelong aspects of learning and teaching have a straightforward and complex relationship, including personal and professional development. This relationship enables opportunities for developing higher education as the highest level of the formal educational system. Therefore, higher education is a vital link to earlier levels, from kindergarten to upper secondary education. However, to be a part of an educational system from the cradle to the grave, higher education also needs to link to working life to offer continuing education and professional development beyond the formal degree programs they offer their students. To fulfil these promises of higher education, for example, one needs to find opportunities to collaborate with organisations in the surrounding society by offering courses built on the needs of professionals and organisations. However, such conditions are not limited to organisations in society. To be updated and relevant as a change agent in society, higher education institutions also need to offer continuing professional development for their employees.

Therefore, creating conditions for development is an important task. In other words, to enable opportunities for professional development in working life, higher education should offer lifelong learning opportunities for their employees. For many decades, the implementation of emerging digital technologies has been one field where higher education institutions need to support their employees with professional development. As mentioned in the 1990s by Anderson and Garrison (1998, p. 101), “nearly every communication medium has been adapted” and implemented in higher education settings. This development or movement in higher education continues while it follows the technological development in society. Subsequently, higher education institutions need to supply their employees with professional development throughout their working life.

2.2 The HEaD project

The Higher Education and Digitalisation (HEaD) project is a five-year initiative at Mid Sweden University to improve its capacity in the field of technology-enhanced and lifelong learning. The project not only focuses on developing the teachers’ pedagogical digital competence but also aims to improve the support structure available to teachers with respect to such competence development. Within HEaD, educational development projects are used as a means for teachers and support functions to collaborate on a joint development goal, as well as to develop their own competencies. As such, educational development projects can be seen as the core of the competence development activity as depicted in Figure 1. These educational development projects originate from teacher needs and opportunities, and thus an intrinsic motivation for teachers exists. Moreover, these projects provide concrete cases for educational developers and IT personnel to discuss with teachers, creating an interface for the exchange of knowledge, ideas and needs. Finally, the projects also create an opportunity to be studied by researchers in pedagogy, as well as to involve teachers more in action research.

In total, the HEaD project aims to run 34 of these development projects with a wide spread of topics and involved subjects. Besides co-financing the educational development projects, the HEaD initiative will also support teachers in initiating and conducting the projects, as well as in spreading their results. In 2021, the first four development projects were initiated in a pilot round. Each project is run by a team of teachers, collaborating with pedagogic developers, IT specialists, and researchers in the area of technology-enhanced learning. Thematically, the four pilot cases focus on: (1) interactive educational resources for increased activity in distance education; (2) simulations as a tool to train skills and situational awareness; (3) new approaches for audio-visual course design; and (4) student-teacher and student-student interaction in distance communication programmes.

Figure 1: Model of the HEaD project using development projects as concrete cases for teachers, support and researchers to interact on pedagogical competence development

2.3 Security regulations in the Swedish higher education context

Since Mid Sweden University is an authority, the same rules apply to the university as other Swedish authorities. This means that we are for example obliged to comply with the information security regulations issued by The Swedish Civil Contingencies Agency. We also must comply with the EU regulations, especially the General Data Protection Regulation (GDPR). This means that the expectations of teachers and students cannot always be met because some of the tools requested are not always intended for a professional environment. There are requirements for cloud service providers that social media platforms and pure entertainment services simply cannot meet. Their target group is not professional users, and their services are not developed to meet the demands of a company or a public business.

As a government agency, we need to be sure that the information in the cloud is protected based on the aspects of confidentiality, accuracy, and availability. All new cloud services requested by the users must undergo a procedure where the service is analysed and evaluated based on the requirements of an authority. A decision is then made on whether the service is approved to use within the university or not. It is therefore important to raise awareness among users about the challenges facing new cloud service providers and to ensure that the users have the right knowledge of existing and approved tools that often meet their requirements but which they may not be aware of.

3. Method

This study was carried out with an action research approach where the authors also have been teachers and facilitators in the HEaD project. Action research has been presented as a practical but systematic research method *"that enables teachers to investigate their own teaching and their student's learning"* (Nolen & Putten, 2007, p. 401*)*. The action research chosen for this study was in the British tradition as described by Norton (2009,

p. 71), an approach *"that links research to improvement of practice and is education orientated"*. With the idea that research results should have a positive impact on best practices in the next version of projects for educational development in the HeaD project. Furthermore, and also a recommendation by Norton (2009), academics should act as reflective practitioners in the higher education landscape to improve the teaching and learning processes. Finally, as suggested by Arnold and Norton (2021), action research should strive to bring change, innovation and educational development.

3.1 Data collection

Data were collected in a combination of course participants who submitted project plans and workshop discussions that were written down and saved with the use of the digital notice board tool Padlet. In an early stage of the development projects a preliminary project plan should be submitted, and later discussed with the project facilitators. Plans should involve things such as a presentation of the general idea, a time plan, a description of the alignment to teaching and learning activities, a method description, and an outline for how to evaluate the project. In an online workshop project participants first discussed potential obstacles in educational development, and later discussed group by group which aspects can make pedagogical development successful. The last part of the workshop was a general discussion where all participants shared ideas. Main ideas from all the workshop discussions were written down on so-called 'Padlet walls' (Ellis, 2015). This study used homogeneous purposive sampling, a method that focuses on a specific subgroup in which all the sample members share the same traits (Rai & Thapa, 2015). In this study, all the 10 informants, five men and five women, were university teachers from the Mid Sweden University, and participants in the HEaD project.

3.2 Data analysis

Data were analysed thematically and grouped into the four categories of Challenges, Opportunities, Tools and Techniques. Categories were created from a summary of frequent topics in the discussions at the online workshop. The analysis was carried out with inspiration from the six-step process outlined by Braun and Clarke (2006), and the top-down analytical approach with predefined categories as described by Lancia (2012). Out of the predefined categories, new themes emerged from the data in an analytical process that could be defined as a deductive-inductive analysis. The results from the thematic analysis have been presented with a grouping by the predefined categories, but with a discussion focus on the new emerging themes or subcategories. A few of the quoted comments were written in English on the Padlets walls, but the majority were written in Swedish, and have been translated to English by the authors. The translation was carried out with the idea of keeping the essential meaning but omitting Swedish idioms that would not make sense in English.

3.3 Ethical considerations

As in most forms of action research, authors had to consider the dual roles of being both teachers and researchers. A duality that was relatively easy to handle in this limited study, but with a risk for increased bias in future iterations. As pointed out by Nolen and Putten (2007, p. 403*)*: *"When the researcher is a member of and plays a role in the system under investigation, issues surrounding role definition, role ambiguity, and role conflict are often significantly greater than when a researcher enters the school as an objective outsider".* All informants have participated according to the principle of informed consent. With respect to informant integrity, all course participants have been kept as anonymous as possible.

4. Findings and discussions

Data sources have been thematically analysed and grouped into the predefined categories of Challenges, Opportunities, Tools and Techniques.

4.1 Challenges

In the comments from the first workshop activity, several potential challenges can be found. Several participants brought up issues with project management and the lack of concrete planning for how the project should be conducted. Several comments also on limited technology, lack of time to explore alternative solutions, and the problem with an overloaded IT Helpdesk. This could be interpreted as expressions for problems in previous projects, and one of the informants wrote that there is an issue *with "Overloaded staff at the IT-helpdesk, who have to answer simple questions that could be answered by colleagues, instead of helping out with the educational development"*. There are also worries that the projects could lack alignment with the university, the

actual department and the daily teaching and learning activities. Informants wrote on the Padlet walls that *"Projects might not be well-aligned to the daily activities"*, and that *"Project plans that are not concrete enough, could make the project go down the drain, or that there will be more of talking than doing"*.

Furthermore, there were concerns about the security restrictions for testing new technology, and that the Moodle virtual learning environment would not be flexible enough for the implementation of all project ideas. Another comment was on the more general risk of getting hampered or limited by university regulations. One informant raised the question about appropriate data collection for the project evaluation, and another mentioned the problem with internal communication, and how and where to share ideas. Finally, several informants bring up the risk of ending up in time trouble, either by getting stuck in their daily work or by poor project management. Another mentioned challenge is that the HEaD overhead' could steal time from the actual project work.

4.2 Opportunities

A lot of interesting opportunities were found, both in project plans and on the Padlet walls. There are also examples of when opportunities could build on challenges like it often is in action research. This could be summarised in the comment with *"There are more general problems to address where their solutions could improve the daily work"*. What is pointed out as a crucial opportunity is *"Easy access to resources that can be explored in the projects"*. An idea could be to create a digital repository, storing resources that pass the security regulations. Easy to write in a research paper, but not that hard to implement either as a part of the university intranet. Another opportunity for a five-year project is certainly "*To create animated meeting fora for teacher-to-teacher discussions", to share the lessons learnt from projects"* and *"Investigating best practices in the field of technical and pedagogical solutions"*. Followed up by *"Mapping the found best practices to teachers' and students' actual needs"*.

Moreover, it seems as an important opportunity *"To add value by documentation, evaluation and dissemination"*, and to enable Interaction and discussions with colleagues, teacher teams, and students. A way of facilitating projects would be by "support from the university's internal and external networks", that is specialised in technology-enhanced learning. With thorough support, it would be opportunities for *"Concrete development, testing and evaluation"*. Moreover, facilitators should encourage project members to "use our new digital toolbox with an open mind" and facilitate *"The internal communication"*. This might be implemented as workshops and seminars to share and compare the best practices that emerge from the projects. Comprising the idea of future HEaD projects that work with further development of completed project deliveries.

4.3 Tools

The submitted project plans include several tools where the majority are communication and feedback tools. During the online workshop, project participants brought up the need for new add-on tools to improve both the teacher-student dialogue and the student-student dialogue. In the university's ordinary toolbox teachers have the Moodle virtual learning environment for asynchronous activities, and the Zoom video conferencing system for synchronous teaching and learning activities. Two systems that offer a reliable ground for most university courses, but there also is a need for more informal communication, and tools that support extra-curricular activities. In the same way, as the pandemic has increased the need for technology-enhanced learning, there seems also to be an increased need for more informal communication to break isolation and increase student satisfaction. An example of a popular tool for informal communication is Discord. A tool that initially was developed for the gaming community, but later has become a popular social platform for a more general younger audience (Cortés-Ramos et al., 2021).

Another interactive tool for teacher - student communication is FeedbackFruits, with the potential to stimulate active learning through instant feedback. A tool that seems to have the potential to support student engagement and a more agile teaching style (Rinaldi & Hasan, 2021; de Kok & Nguyen, 2021). All of the tools mentioned above are fully developed and user-friendly. Tools that could be used by all teachers and students, and tools that are relatively easy to install. On the other hand, they might clash with the security regulations described under 2.3, and the GDPR privacy and security law. Finally, a more complex tool that bridges over to the next category of techniques, the HTML5 Package (H5P). A package including the HTML5 components HTML, Cascading Style Sheets and Javascript, and a package that can be integrated with the Moodle virtual learning environment (Wehling et al., 2021). With the use of H5P, teachers or students can relatively easily create

interactive content such as quizzes, drag and drop assignments, voice interaction or interactive videos (Hettiarachchi, 2021).

4.4 Techniques

H5P could also be seen as a technique to align teaching and learning activities with the revised version of Bloom's well-known taxonomy of cognitive levels (Desai & Kulkarni, 2022). Bloom's Taxonomy is a classification of the six levels of thinking that should be considered in the creation of course objectives and course activities. This taxonomy was also brought up in the discussions at the online workshop where participants and facilitators agreed on the relevance of involving Bloom's Taxonomy in pedagogical development with H5P as an interesting tool for constructive alignment. Another technique mentioned in the project plans is mannequin simulation, a frequently used technique in nursing education and healthcare programmes. Simulation mannequins could briefly be described as realistic dolls that could monitor and display techniques such as pulse, blood pressure, EKG and arterial wave forms. Before the Corona pandemic mannequin simulation worked well in onsite activities, but the technique needs adoption for pure distance teaching. An alternative would be to use virtual reality simulations, but as highlighted in the workshop discussions high-fidelity mannequins would probably be a better stress test. Finally, a technique for improved visual communication presented in a project plan is the so-called boxing technique. Boxing should here be interpreted as a grouping of course content with an appealing graphic design. A concept resembling the 'Box layout' in the Java programming language or the boxing of content in web design that is implemented with the use of cascading style sheets. Boxing should support symmetric as well as asymmetric design ideas with the idea of flexible modularisation that is described in (Hampton-Smith, 2016).

4.5 Emerging themes

Three new themes emerged from the analysed data, where all of them can at the same time be seen as both challenges and opportunities, and partly as techniques. If considered in the future project batches, they all have a potential to improve the educational development.

Planning

Findings show examples of both careful planning as well as lack of planning. A thoughtful comment was that there should be a "*project planning that shouldn't overload the facilitating resources"*. Several participants also brought up worries over how to use the given time resources. Project management looks like a crucial factor and there are comments on the Padlet wall about *"What to do and when"* and," How *to involve students and colleagues, and to what degree"*. Regarding the limited time quota for the projects, it must be important to *"Have a realistic workload and continuous-time for the development project".*

Methodology

There were also comments on "*Support for relevant methodology and appropriate data collection"*, which of course could be a part of activities in later workshops. Besides the requests for research methods, there was also a question about project management methods and how to *"Use an agile project form".* The Padlet section on 'Literature and writing' was empty and without any comments, something that raises the question about a recommended literature list.

Discussion and dissemination

What appears to be a sensible question is *"How to reach out to colleagues, teacher teams and other departments at the university?".* Something that could be arranged in collaboration with the facilitators and instructors in the HEaD team. Moreover, it is important with *"Interaction with students and student unions"* and to get continuous feedback from students. Finally, a positive finding was that some participants brought up the idea of presenting results at international conferences and publishing in quality research journals.

The workshop activities started with discussions on challenges, which might explain the rich number of comments on project details that might go wrong. In the next batch of projects, the order should be shifted, with project opportunities discussed first. The data collected in this study is limited to only four projects. In the

next project batch, involving 10 development projects, the relations in Figure 2 here below could be further evaluated and extended.

5. Conclusion

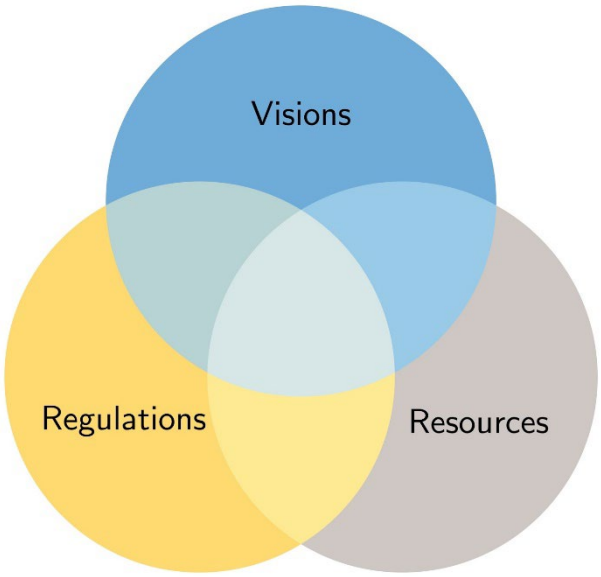

Figure 2 Sustainable educational development projects occur in the intersection between teachers' visions, regulations and available resources

With the aim to analyse the perceptions of participants in a five-year university initiative on technology-enhanced and lifelong learning, data on perceived challenges and opportunities, as well as planned techniques and tools were studied. The data showed that the participants had clear visions and ideas regarding applicable techniques and tools, but that challenges are expected particularly with respect to time and resource management, as well as available support. It becomes obvious that educational development occurs in the cross-section of the teachers' visions and ideas, the regulations the university has to follow, as well as the available resources for implementation and continued management (see Figure 2). In order to lead to sustainable solutions, all three components need to be considered and intersecting regions need to be found. It also seems obvious that the manner in which educational development projects are conducted can have a tremendous impact on finding the sweet spot for sustainable educational development activities. Early involvement of key stakeholders in the development process is essential, which confirms the HEaD model of connecting teachers with domain specialists right from the start. However, the involvement of management in such dialogues could be further strengthened to address the resource aspect, as many participants lifted concerns about the effect of high workloads.

6. Future works

The lessons learnt from this study will be applied in the outline of the next batch of projects. With the action research idea of an iterative improvement, all batches of projects should be evaluated and analysed to improve the quality of educational development. Results from the development projects should be disseminated both internally at the university, and externally by research publications. There is a current a boom of articles dealing with the aspects of education development during and after the pandemic. In this article we have just scratched on the surface, and our estimation is that this emerging field would require a separate study on its own. Important topic to bring up in this future study would be to explore the importance of relevant methods in educational development projects as suggested by Godsk (2022). Another topic to consider is the need for an inclusive framework for the scholarship of educational development as pointed out by Cruz et al. (2022). Finally, the model suggested above is a first draft that should be evaluated and refined both by project results, and by a systematic literature review on 'Educational development'.

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References

Agnoletto, R., & Queiroz, V. 2020. COVID-19 and the challenges in education. *The Centro de Estudos Sociedade e Tecnologia (CEST)*, *5*(2).

Anderson, T., & Garrison, R. 1998. Learning in a networked world: New roles and responsibilities. In C. C. Gibson (Ed.), *Distance learners in higher education: Institutional responses for quality outcomes* (pp. 97-112). Atwood.

Arnold, L., & Norton, L. 2021. Problematising pedagogical action research in formal teaching courses and academic development: A collaborative autoethnography. *Educational Action Research*, *29*(2), 328-345.

Baporikar, N. 2016. Lifelong learning in knowledge society. *In Impact of Economic Crisis on Education and the Next-Generation Workforce* (pp. 263-284). IGI Global.

Billett, S. 2010. The perils of confusing lifelong learning with lifelong education. *International Journal of Lifelong Education, 29*(4), 401-413

Braun, V. & Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative research in psychology, 3*(2), pp.77-101.

Bridgstock, R. 2017. The university and the knowledge network: A new educational model for twenty-first century learning and employability. *In Graduate employability in conte*xt (pp. 339-358). Palgrave Macmillan, London.

Cortés-Ramos, A., Torrecilla García, J. A., Landa-Blanco, M., Poleo Gutiérrez, F. J., & Castilla Mesa, M. T. 2021. Activism and Social Media: Youth Participation and Communication. *Sustainability*, *13*(18), 10485.

Cruz, L., Dickens, E., Flaming, A.L.B. and Wheeler, L.B., 2022. Embracing complexity: an inclusive framework for the scholarship of educational development. *International Journal for Academic Development*, *27*(1), pp.45-57.

de Kok, E., & Nguyen, N. 2021. Utilizing Pedagogical Technology to Facilitate Peer and Group Feedback in Hybrid Courses-A Case Study.

Desai, T. S., & Kulkarni, D. C. 2022. Assessment of Interactive Video to Enhance Learning Experience: A Case Study. *Journal of Engineering Education Transformations*, *35*(Special Issue 1).

Ellis, D. 2015. Using Padlet to increase student engagement in lectures. In *14th european conference on e-learning: ECEL 2015* (pp. 195-198).

Godsk, M., 2022. Learning Design as an efficient educational development methodology: conceptualization, assessment, and practice. In *Handbook of Digital Higher Education* (pp. 38-50). Edward Elgar Publishing.

Hampton-Smith, S., 2016. CSS Flexible Box Layout. In *Pro CSS3 Layout Techniques* (pp. 73-101). Apress, Berkeley, CA.

Hettiarachchi, E. 2021. Online Workshop on Creating Interactive learning Content using H5P.

Jaldemark, J. 2020. Formal and informal paths of lifelong learning: Hybrid distance educational settings for the digital era. In M. Cleveland-Innes & R. Garrison (Eds.), *An introduction to distance education: Understanding teaching and learning in a new era* (2nd ed., pp. 25-42). New York: Routledge.

Kirkwood, A. & Price, L., 2014. Technology-enhanced learning and teaching in higher education: what is 'enhanced'and how do we know? A critical literature review. *Learning, media and technology*, *39*(1), pp.6-36.

Lancia, F. 2012. T-LAB pathways to thematic analysis. *Retrieved on October*, *26*, 2012.

Mozelius, P. 2020. Post Corona Adapted Blended Learning in Higher Education. *In Responding to Covid-19: The University of the Future:* / [ed] Dan Remenyi, Ken A Grant and Shawren Singh, Reading, UK: ACIL

Nolen, A. L., & Putten, J. V. 2007. Action research in education: Addressing gaps in ethical principles and practices. *Educational researcher*, *36*(7), 401-407.

Norton, L. 2009. *Action research in teaching and learning: A practical guide to conducting pedagogical research in universities*. Routledge.

Rai, N., & Thapa, B. 2015. A study on purposive sampling method in research. *Kathmandu: Kathmandu School of Law*, 1-12.

Rinaldi, M., & Hasan, D. 2021. Stimulating active participation with class materials using Interactive Document. *e-mentor*, (3 (90)), 84-90.

Terenko, O., & Ogienko, O. 2020. How to Teach Pedagogy Courses Online at University in COVID-19 Pandemic: Search for Answers. *Romanian Journal for Multidimensional Education/Revista Romaneasca pentru Educatie Multidimensionala*, *12*.

Tolks, D., Kuhn, S., & Kaap-Fröhlich, S. 2020. Teaching in times of COVID-19. Challenges and opportunities for digital teaching. *GMS journal for medical education*, *37*(7).

Wehling, J., Volkenstein, S., Dazert, S., Wrobel, C., van Ackeren, K., Johannsen, K., & Dombrowski, T. 2021. Fast-track flipping: Flipped classroom framework development with open-source H5P interactive tools. *BMC Medical Education*, *21*(1), 1-10.

Williamson, T. 2008. The good society and the good soul: Plato's Republic on leadership. *The Leadership Quarterly*, *19*(4), 397-408.

Offline and Online Practices for Assembly Language Programming With 8085 Microprocessor

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Abstract: The COVID-19 pandemic has meant that distance teaching and learning at educational institutions since 2020 has become common place. The Ministry of Education in Bhutan has taken the initiative to educate students using learning television and Internet-based online education instead of traditional classes. Thus, the Royal University of Bhutan (RUB) and its ten constituent colleges have been swift in transitioning to online teaching through Moodle and varieties of other applications such as ZOOM, Big Blue Button and Google classroom since March 2020. Since then, offline and online blended teaching began at the College of Science and Technology (CST) under RUB in January 2021. In this paper, we focus on offline and online teaching and learning practices for assembly language programming with the 8085 microprocessor. A Zoom meeting is used for the online practical. Firstly, a tutor gives an 8085 assembly program lesson, which is common to both offline and online teaching practices. In the case of the offline practice, students assemble the assembly program into Hexadecimal code, by looking up a table of the 8085 instruction set. Finally, the Hexadecimal code is input and executed on an 8085 microprocessor trainer, and students confirm the output from the trainer. Here, the trainer is a small computer composed of a microprocessor, peripheral/communication interfaces, timer, memory, input device and output device. In the case of the online practice, on the other hand, students input the assembly program directly on a Web-based 8085 microprocessor simulator. We developed an 8085 microprocessor simulator using JavaScript. Then, students confirm the output from the simulator on a Web browser. The students took 6 offline learning practices and 4 online out of a total of 10. According to a questionnaire survey about the comparison of the offline and online practices from the students, they say offline practices are much better than online ones, because direct communication is important to understand the learning contents. We conclude that there is room for improvement in the online teaching methods.

Keywords: traditional practice, online practice, Zoom, simulator, 8085 microprocessor

1. Introduction

At present, the number of new COVID-19 cases is decreasing each day all over the world. Thus, more countries are relaxing their lockdown measures. In the field of education, many schools and colleges have been shifting from online teaching to offline teaching recently. At CST (College of Science and Technology), RUB (Royal University of Bhutan), classes were taught using both offline and online methods in equal measures in the spring semester of 2022, but will be taught using only offline from the autumn semester of 2022.

However, people found benefits of online teaching during the COVID-19 pandemic. For example, it is easy to record online teaching classes. In the case of the Zoom meeting service, students can record a class video and audio locally to a computer (Zoom Support, n.d.). Also, online teaching is comfortable for both teachers and students, because they can stay at home with casual wear while they are teaching or learning at classes (Ashley, 2020).

In this paper, we focus on teaching methods for assembly language programming with the Intel 8085 microprocessor. Then, we compare online practice using a Web-based 8085 microprocessor simulator with offline practice using the Vinytics VMC-8501 microprocessor trainer, and discuss the advantages and disadvantages of each based on their experience. The methodology is described in section 2. Section 3 is an explanation of the offline teaching practice with the above-mentioned microprocessor trainer. The 8085 microprocessor simulator is described in section 4. In section 5, we describe the online teaching practice with the 8085 microprocessor simulator and the Zoom online meeting service. Section 6 is a comparison between offline and online methods based on the results of a questionnaire completed by students of CST. Advantages and disadvantages of offline and online practices are discussed in section 7. The conclusion is given in section 8.

2. Methodology

The purpose of this research paper is to find advantages and disadvantages of offline and online teaching practices for 8085 assembly language programming, respectively. Then, we propose a better online practice.

In order to find advantages and disadvantages of the offline and online practices, students take both offline and online lessons for 8085 assembly language programming. Next, they answer the questionnaire about the offline

and online methods on a Google online form. We find the advantages and disadvantages from the questionnaire results. Finally, we discuss how the online practices can be improved.

3. Offline practice

Offline lessons are given at a laboratory. Two students form a group, and each group uses the Vinytics VMC-8501 microprocessor trainer, as mentioned above. The tutor provides several assembly language programs, and the students execute the assembly program on the microprocessor. Then, they confirm the output from the trainer. Thus, they understand the assembly instructions. While they are learning, they communicate with the tutor or each other orally. The steps of the offline practice are as follows.

3.1 Explanation of objective and apparatus required

The tutor uploads practice notes on Moodle in advance. Then, he/she explains the objective and apparatus required of today's practice while students are reading them on Moodle with their smartphones. Figure 1 shows an example of them.

Table 1 Example of objective and apparatus required.

Objective:			
	Instructions related to rotating the accumulator bits are introduced. In addition, two types of Compare operations will be introduced. In this practical, firstly we learn the mnemonics of these operations. Next, we input several simple programs including the above operations, and check the results.		
Apparatus Required:			
	8085 Microprocessor Trainer	Vinytics VMC-8501	1
	Manual	Vinytics VMC-850X User's Manual	1

3.2 Explanation of 8085 assembly instruction set

Secondly, the tutor teaches the 8085 assembly instruction set which is used in today's practice on a whiteboard, based on a textbook that he/she refers to in a lecture (Gaonkar, 2013). Figure 1 shows an example of the explanation of an 8085 assembly instruction set.

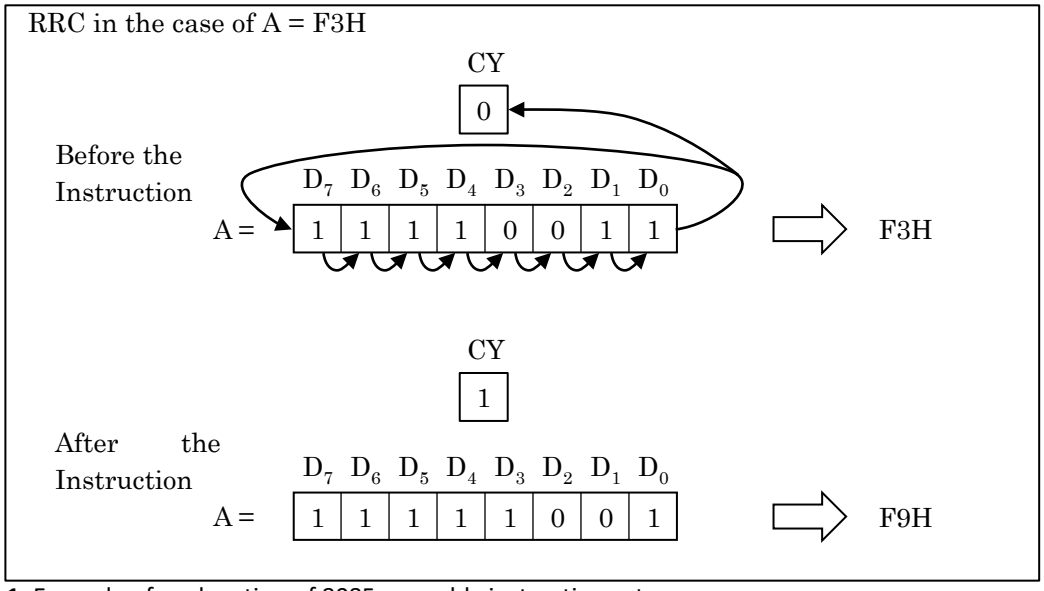

Figure 1: Example of explanation of 8085 assembly instruction set

3.3 8085 assembly language program and its assembling by manual

Thirdly, the tutor gives the 8085 assembly language program as shown in Figure 2. Then, the students translate the assembly program into hexadecimal machine code by the use of the Vinytics VMC-850X user's manual shown in Figure 3. This translation process is called assembling.

```
                    A    PC    S    Z    AC    P    CY
                                                    Initial Contents
    MVI  A,F3H
    ORA  A
    RRC
    HLT
```

Figure 2: Example of 8085 assembly language program

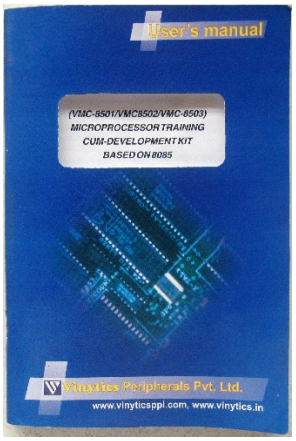

Figure 3: The Vinytics VMC-850X user's manual

Using the user's manual, the students find the hexadecimal machine code as 3E, F3, B7, 0F, 76.

3.4 Input of hexadecimal machine code and its execution on the microprocessor trainer

Fourthly, the students input the hexadecimal code on the trainer, and execute it. The Vinytics VMC-8501 microprocessor trainer is shown in Figure 4 (Vinytics, n.d.).

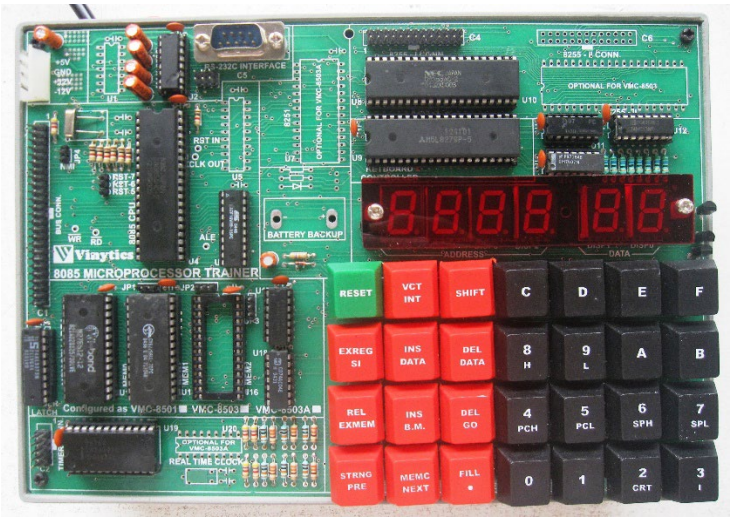

Figure 4: The Vinytics VMC-8501 microprocessor trainer.

3.5 Confirmation of output from the microprocessor trainer

Finally, the output of the hexadecimal code is displayed on six-digit seven-segment LED of the trainer. The students confirm it, and fill in the blanks in Figure 2. The results are given in Figure 5.

	A	PC	S	Z	AC	P	CY	
	00	2000	0	0	0	0	0	Initial Contents
MVI A,F3H	F3	2002	0	0	0	0	0	
ORA A	F3	2003	1	0	0	1	0	
RRC	F9	2004	1	0	0	1	1	
HLT								

Figure 5: Output of 8085 assembly language program

4. Web-based 8085 microprocessor simulator by JavaScript

In the case of offline practices, students use a Web-based 8085 microprocessor simulator. The microprocessor simulator is composed of three modules: GUI (Graphical User Interface) module, Main module, and Execution module. In Muramatsu (2012; 2014), the author developed the Main and Execution modules by PHP (Personal Home page), and the GUI module by JavaScript. Then, the Main and Execution modules run on a Web server, and the GUI module runs on a client PC. If many students use the simulator simultaneously, a heavy load may be applied to the Web server, which is a disadvantage (Mindfire Solutions, 2018).

Therefore, the author rebuilt the 8085 microprocessor simulator as all the three modules run on a client PC for online practices. Namely, the three modules were rebuilt by JavaScript. Figure 6 shows data flow between each module. The details of each module are described as follows.

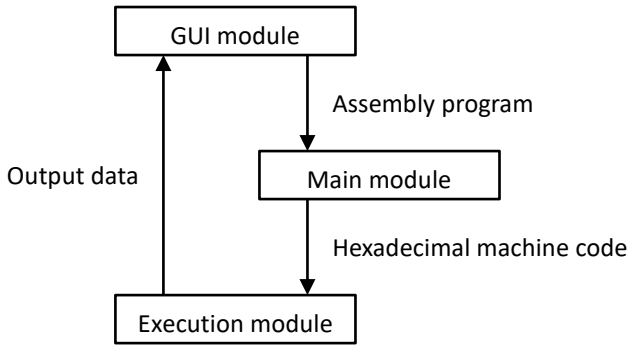

Figure 6: Modules and data flow in the 8085 microprocessor simulator by JavaScript

4.1 GUI module

Students input the assembly program using the GUI module on their PC, and the input program is sent to the Main module. Also, the GUI module displays the results of a Hexadecimal machine program transferred from the Execution module.

4.2 Main module

The Main module translates an assembly language program sent from the GUI module to a Hexadecimal machine code on their PC. The Hexadecimal machine code is sent to the Execution module.

4.3 Execution module

The Execution module executes the Hexadecimal machine code received from the Main module, and transfers its results to the GUI module. These processes are done on the students' PC. Here, the results mean the contents of registers and memory locations on the 8085 microprocessor after the execution.

5. Online practice

In the case of online teaching practices, the students take the lessons at their home individually. If they want to communicate with the tutor or the other students, they can use a personal or group chat on the Zoom online service. Compared with offline practice, online practice is simple. Explanation of objective, apparatus required and 8085 assembly instruction set, is almost the same as for the offline practice. The difference is that the explanation is given using Zoom, not directly (Zoom, n.d.). The tutor also gives the 8085 assembly language program using Zoom. In addition, students do not need to assemble the assembly program, because the Main module of the simulator translates it to the Hexadecimal machine code.

Thus, students launch the 8085 microprocessor simulator shown in Figure 7 on their PC, after the 8085 assembly language program is allocated. Next, they input the 8085 assembly program with a keypad on the simulator as shown in Figure 8. By clicking the 'RUN' button, finally, the program is executed, and its results are displayed on the microprocessor simulator. See Figure 9.

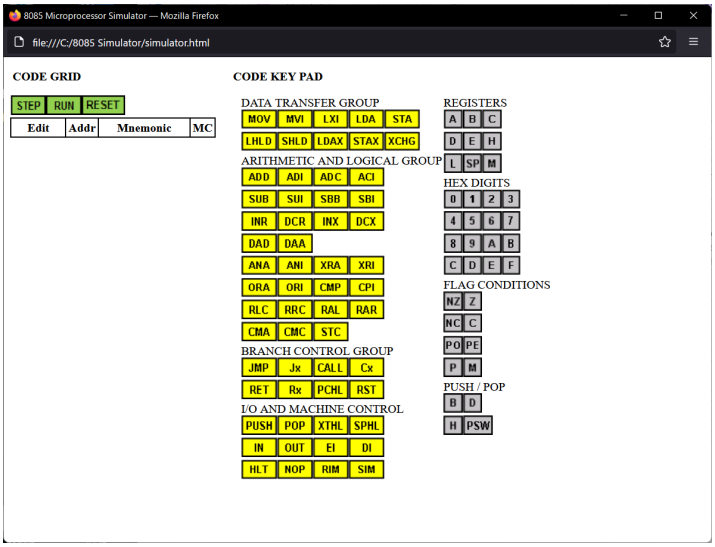

Figure 7: Initial screen of the 8085 microprocessor simulator

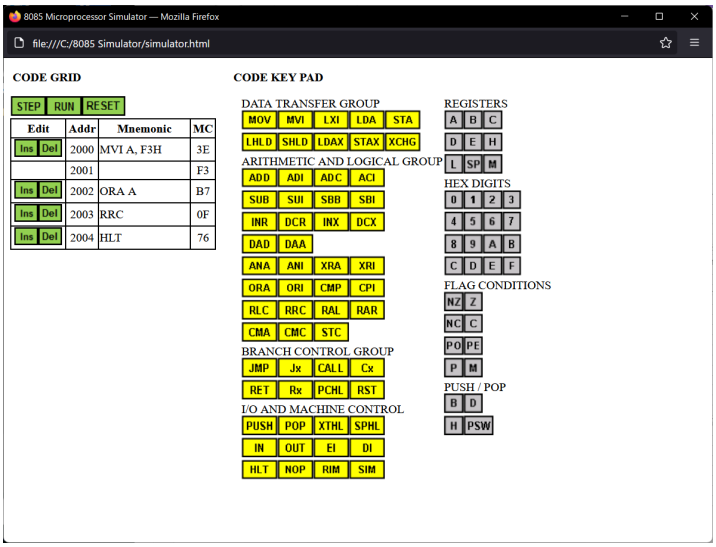

Figure 8: Input of the assembly language program on the 8085 microprocessor simulator

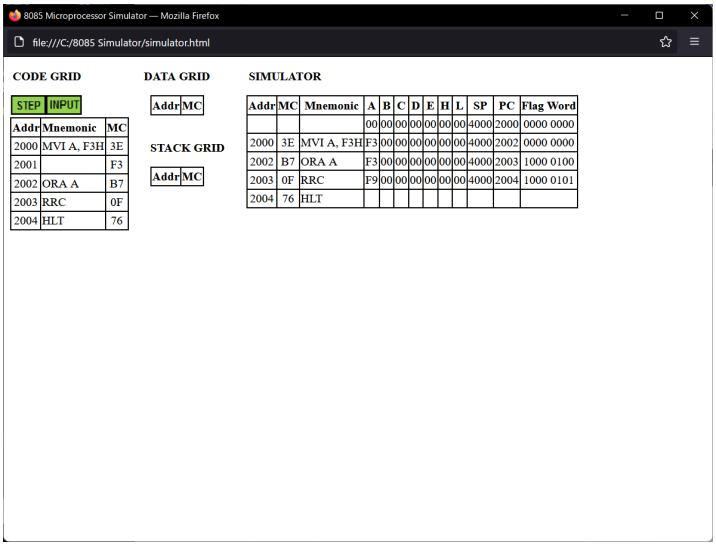

Figure 9: Output of the assembly language program on the 8085 microprocessor simulator

6. Comparison between offline and online practices

In this section, we describe the results of a questionnaire about the comparison between offline and online practices. Twenty two students of the Instrumentation and Control Engineering Course, CST took six offline and four online out of ten practices in the spring semester of 2021. Then, eight students responded to the questionnaire.

Firstly, the author asked which is better, online practices or offline practices in the questionnaire. 75% of the students answered that the offline teaching practice was much better than the online for their learning experience.

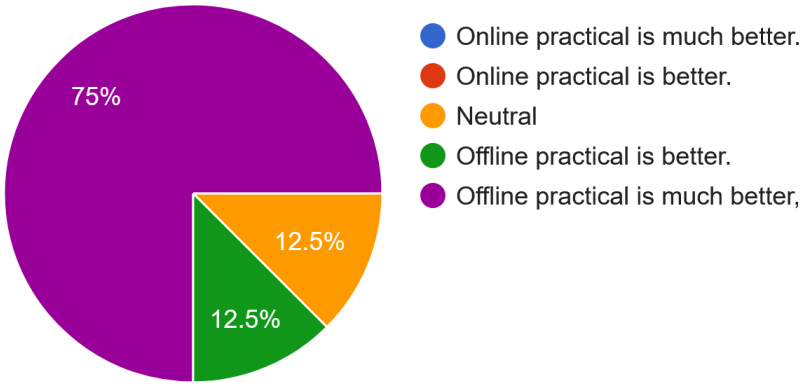

Figure 10: Which is better, online practices or offline practices

The reasons for the above answer are listed as follows.

- Offline practices are much more efficient and easy to understand.
- We get hands-on experience using offline methods.
- We can ask the tutor about doubts face to face.
- Both are good. In online practices, we can do it faster and see the display easily and individually. In offline practices, we are learning with classmates, and the classmates can explain doubts even if we don't understand.

Secondly, the author asked about the advantages of online practices. The response was as follows:-

- We can review the lessons individually if we use a local recording function on Zoom.

Thirdly, the author asked about the advantages of offline practices. The responses were as follows:-

- We can ask classmates or the tutor directly anytime in practice hours if we have doubts.
- We can get knowledge of the I/O interface with the microprocessor by using the microprocessor trainer.
- We can get much more information about the hardware, compared with online practices.

Fourthly, the responses to disadvantages of online practices were as follows:-

- We are unable to focus our mind on the practices properly.
- It is difficult to understand the contents with the microprocessor simulator.

Finally, the response to disadvantages of offline practices was as follows:-

- If the number of the microprocessor trainers is small compared with the number of students, a large group of students uses only one trainer. This situation makes the students not want to join in the lessons.

7. Discussion

According to Figure 10, 75% of the students feel offline practices are much better than online ones. The reason is that offline practices make it easier to communicate with classmates and the tutor even though Zoom online meetings support a group chat function. This means that face-to-face communication is better than one with an online chat. However, Ashley (2020) states that online teaching increases students' access to teachers, because HeyHi's online whiteboard service is effective in communication (HeyHi, n.d.). Thus, methods of communication should be improved in online practices. In offline teaching practices, it is important to handle hardware equipment, because students can understand the hardware aspect of the microprocessor through the microprocessor trainer. In online practices, on the other hand, the Zoom recording function is useful, because students can review the lessons by watching the recorded video anytime (Zoom Support, n.d.). This advantage is mentioned in Ashley (2020).

8. Conclusion

Based on the results of the questionnaire completed by the students of the Instrumentation and Control Engineering Course, CST, in this paper, we compared offline teaching practices and online ones. The results say that 75% of students feel offline practices are much better than online ones, because offline practices make it easier to communicate with each other. Therefore, online practices should be improved by developing user-friendly communication tools.

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References

Ashley, 2020. *7 benefits of online teaching for teachers.* [blog] Available at: <https://blog.heyhi.sg/benefits-of-online-teaching-teachers/> [Accessed 31 August 2022].

Gaonkar, R. S., 2013. *Microprocessor architecture, programming and applications with the 8085*. Mumbai: Penram International Publishing.

HeyHi, n.d. *HeyHi – Online learning space.* [online] Available at: <https://www.heyhi.sg> [Accessed 31 August 2022].

Mindfire Solutions, 2018. *Advantages and disadvantages of PHP frameworks.* [online] Available at: <https://medium.com/@mindfiresolutions.usa/advantages-and-disadvantages-of-php-frameworks-c046d50754e5> [Accessed 31 August 2022].

Muramatsu, K., 2012. Development of web-based 8085 microprocessor simulator and its implementation on LMS. *International Journal of Applied Engineering Research*, 7(11), pp 1209-1213.

Muramatsu, K., 2014. SCORM packaging of 8085 microprocessor simulator and its evaluation on Moodle. In: Yáñez, T. A., Rodriguez, O. S., and Griffiths, P. eds., *Proceedings of the 9th International Conference on e-Learning*. Valparaiso, Chile, 26-27 June 2014. Sonning Common: Academic Conferences and Publishing International.

Vinytics, n.d. *8085 microprocessor kit with LED display (VMC-8501)*. [online] Available at: <http://vinyticsppl.com/index.php/products/8085-microprocessor-kit-with-led-display-vmc-8501/> [Accessed 31 August 2022].

Zoom, n.d. *Video conferencing, cloud phone, webinars, chat, virtual events | Zoom*. [online] Available at: <https://zoom.us> [Accessed 31 August 2022].

Zoom Support, n.d. *Recording features – Zoom support*. [online] Available at: < https://support.zoom.us/hc/en-us/sections/4415046067725-Recording-Features> [Accessed 31 August 2022].

A Framework for Transitioning to Virtual Classes During Life-Threatening Pandemics Like COVID-19

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Abstract: This research explains the benefits and challenges of virtual classes as experienced by university students during the coronavirus (COVID-19) pandemic. The limited research on university students' experiences in virtual classrooms during the COVID-19 pandemic, which disrupted physical classes and forced educational institutions to blindly switch from physical classes to virtual classes, served as the inspiration for this study. The absence of a framework for smoothly transitioning from physical classes to virtual classes challenged this process. Furthermore, relatively few studies have been done on the empirical context of a developing nation with distinct social and economic circumstances, concerning university students' experiences of virtual classrooms during COVID-19. Thus a quantitative study using a single case study of a university in Southern Africa was guided by the duality of structure in Giddens Structuration Theory, which explains students' experiences by highlighting both positive aspects—such as flexibility, collaboration, accessibility, and availability of course materials—and negative aspects—such as high costs, boredom, and a lack of resources and training. Analysis was done using Microsoft Excel and the findings also showed how, during the COVID-19 epidemic, structures of dominance, signification, and legitimacy formed as a result of behaviors related to leadership, resources, empowerment, and adoption, which both facilitated and hampered the smooth transition to virtual classrooms. The paper concluded by proposing a framework for transitioning to virtual classes during life-threatening situations like the COVID-19 pandemic. Although not generalizable across all university contexts, these findings provide a foundation for understanding the university students' experiences in virtual classes during COVID-19. These findings have both practical and theoretical implications since they both provide an explanation of experiences in virtual classes as well as propose a framework for guiding the process of moving away from physical classes towards virtual classes during life-threatening situations.

Keywords: COVID-19, virtual classes, experiences, students, benefits of, challenges

1. Introduction

The year 2020 and 2021 brought changes in the way of living globally. During this period, COVID-19 spread across the globe, making it difficult to proceed with activities that required physical contact. Regarding the situation in the COVID 19 era, Dhawan (2020) observes that the " major part of the world is on quarantine due to the serious outbreak of this global pandemic Covid-19 and therefore many cities have turned into phantom cities and its effects can be seen in schools, colleges, and universities too". These sentiments confirm that COVID-19 had a major impact on the day-to-day activities and more on the education system where the mode of instruction delivery required physical classes. As such, higher education institutions were compelled to transition from physical classes to virtual class-based pedagogy (Dhawan, 2020; Vincent-Lancrin, 2022). Online learning became an important aspect of higher education as it could be conducted with minimum or no physical contact, following the health sector government requirements globally. This meant that the students would be distant not only from their instructors but also from each other. Their interaction was only facilitated by technology which could have had either a positive or negative impact on the students. It is against this background that this paper investigates the benefits and challenges faced by students during online learning using a single case study of a Southern African university. Furthermore, a framework is proposed which can act as a guide towards successfully transitioning from physical to virtual learning in future pandemics. Mutunhu (2023) notes that the African context is unique, thus frameworks are required as new technologies are emerging where features and utility of the technology, the context of usage, and the user technology need to

be considered. Thus, the paper starts by outlining the problem statement and objectives of the study, previously done research, methodologies, and finally the discussions and findings of the study.

2. Problem statement

Literature has evidence that despite the need for a well-designed and properly planned transition to virtual classes, the sudden emergence of COVID 19 compelled the education institutions to change the pedagogical approach and immediately shift from physical to virtual classes (Aguilera-Hermida *et al.*, 2021; Dhawan, 2020; Maatuk,2022). Such a swift move impacted both the instructors and students alike because "many higher education institutions were not prepared with appropriate e-learning platforms and online educational resources" (Aguilera-Hermida *et al.*, 2021). Literature also acknowledges that there is limited literature that explains the experiences of students during COVID-19, a period where most classes were turned into virtual classes. These authors, therefore, recommended that future research must focus on students' experience during emergency online learning due to COVID-19. For example, it has also been acknowledged in the literature that "transitioning to online learning due to COVID-19 has been a highly complex undertaking for higher education institutions" (Aguilera-Hermida *et al.*, 2021). This challenge has been worsened by the fact that there are limited or no frameworks to guide the transitioning to virtual classes during the life-threatening pandemics that may hinder the physical classes. On this note, existing literature emphasises the need for research that develops specific strategies and/or interventions that promote the transition from physical to virtual classes in different countries in case of pandemics or natural disasters (Aguilera-Hermida *et al.*, 2021; Mukhtar *et al.*, 2020). It was with this mindset that this study sought to answer the subsequent research questions.

2.1 Research questions

Existing literature has revealed the need for more research on university students' experiences and performance during lockdowns (Aguilera-Hermida *et al.*, 2021). It was on this note that this study sought to establish the university students' learning experiences after transitioning to virtual classes during the COVID-19 pandemic. To achieve this goal, the following questions were to be answered.

- **RQ1:** How did university students benefit from transitioning to virtual classes during the COVID-19 pandemic?
- **RQ2:** What challenges were faced by university students in attending virtual classes during the COVID-19 pandemic?
- **RQ3:** How can the faced challenges be reduced in the future during similar life-threatening pandemics that may hinder physical classes?

3. Related work

Online delivery of education instruction has been researched over the years and has been associated with both benefits and challenges. The benefits of technology-mediated education include flexibility, collaboration, content sharing, easy access to content, etc. Despite the vast knowledge about both the benefits and challenges of e-learning, several studies were conducted to explain perceptions about online learning, and factors influencing acceptance and use of technology during COVID-19. For example, Bdair (2021) conducted a qualitative study relating to nursing students' perspectives about online learning during the COVID-19 pandemic. Their findings revealed both academic achievements such as improved scores and improved technology usage skills as well as challenges like inadequate infrastructure, lack of training, use of varied unfamiliar platforms, distractions from the environment, limited collaboration, increased workload, technological incompetence, etc. Similar studies by Lemay, Bazelais, and Doleck (2021); Salakhova (2022) explored how the pandemic influenced student perceptions of online learning and their results show that in addition to environmental and technological issues, the students experienced social challenges such as stress, anxiety, lack of discipline, communication and interaction problems. A comparative study by Aguilera-Hermida *et al. (*2021) analysed and concluded that attitude, affect and motivation were the major factors that influenced the college students' use and acceptance of technology during COVID-19. Another study by Demuyakor (2020) revealed that students perceived online learning as very useful despite having challenges with internet connectivity. Adedoyin and Soykan (2020) identified technology, intrusion, digital competence, supervision, and compatibility as some of the major challenges of online learning during COVID-19. Dhawan (2020) conducted a Strengths, Weaknesses, Opportunities, & Challenges (SWOC) analysis of e-learning modes in times of crisis like that brought about by COVID-19 and similar natural disasters. Their findings are

summarised in Figure 1. In another study on students' perspective toward online learning, it was established that in addition to convenience and affordability, the students also experience health problems due to prolonged glare on the computing devices (Octaberlina and Muslimin, 2020). Furthermore, it has been argued in the literature that the challenge of online learning during COVID-19 included a compromise of academic integrity, decreased quality, plagiarism, limited attention span, and a lack of attentiveness during class.

The existing literature was however limited to studies conducted in developed countries, which has left a gap in studies involving universities in developing countries, a context with limited resources. It was against this realisation that existing literature acknowledges the fact that not all countries have the same conditions, and that students do not have the same resources to participate fully in virtual class environments (Aguilera-Hermida *et al.*, 2021). Existing literature, therefore, recommends that further studies be conducted on a similar topic, with a focus on cases from different regions (Bdair, 2021; Lemay, Bazelais and Doleck, 2021). There was also a theoretical gap in the reviewed literature since many studies were not guided by any theory for a better understanding. Most importantly, the reviewed literature was limited to a discussion of experiences and failed to provide an alternative framework for transitioning to virtual classes in the future where the educational institutions could be confronted by a similar crisis as that of the COVID 19 pandemic, with an adverse impact on the education based on physical class modes. It was against this backdrop that this study aimed to both explain the students' experiences and develop a framework for transitioning to virtual classes. More so, studies concur that a transition from physical to virtual classes can only be effective if it is well-designed and carefully planned (Aguilera-Hermida *et al.*, 2021).

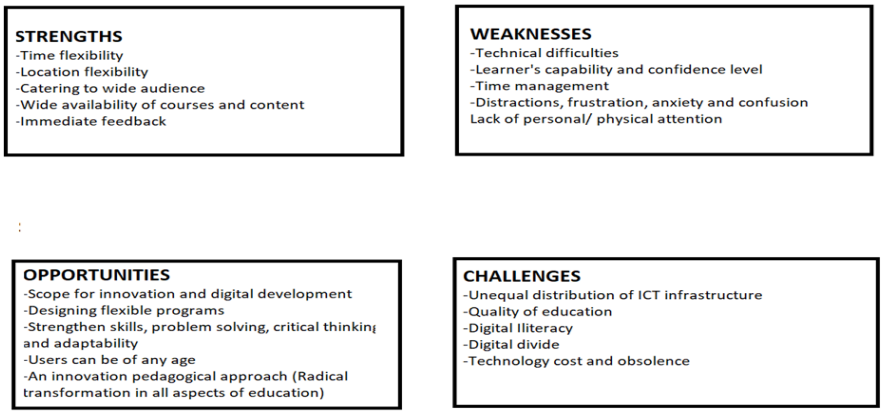

Figure 1: The SWOC analysis of online learning during such crises. Adapted from (Dhawan, 2020)

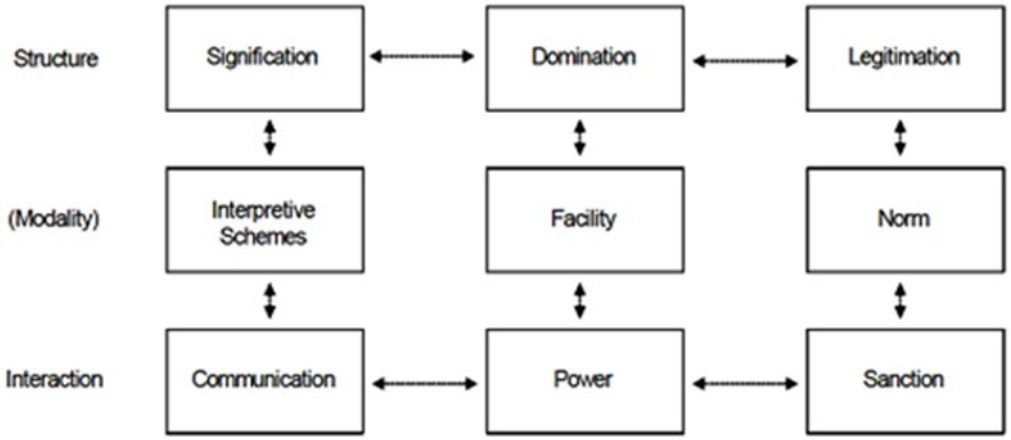

Figure 2: The structuration model (adapted from Giddens, 1984)

Figure 2 shows that there are structures of signification, domination, and legitimation, which through the modalities of the interpretive scheme, facility, and norm can either promote or inhibit the interaction of actors. On this note, this study explains how the structure's signification, domination, and legitimation either benefitted or challenged the university students' participation in virtual classes during COVID-19. To achieve this goal, a closed-ended questionnaire was developed and sent to students as a Google form via email. The

questionnaire was four main sections relating to the demographic information, a section on the benefits of virtual classes, another section on the challenges of virtual classes, and lastly a section on the recommended mode of education. Based on Gidden's (1984) concept of the duality of structure, it was confirmed that there were structures of domination that had the power to either facilitate or inhibit the effectiveness of virtual classes. These structures are revealed in the next section on findings.

4. Methodology

Quantitative data for this study were collected from a single university case in Zimbabwe. Data were randomly collected from a cohort of students enrolled for the Bachelor of Science in Computer Science and the Bachelor of Science in Informatics. It was easy to access and collect data from this cohort because one of the authors teaches courses taken by the students enrolled in those two programs. Data were collected between July and August of the academic year 2021-2022. The participants were drawn from those registered for the second and fourth levels as they are the ones who had experienced online learning from 2020 to 2022. The students in level one and level three were excluded from the study because those in level one did not have much experience in online learning while those in level three were on industrial attachment, with limited involvement in the education activities. Although 200 responses were expected, only 150 questionnaires were fully completed and analysed using Microsoft Excel. The variance could have been influenced by a lack of access to the questionnaire since it was shared during the vacation and some students reside in rural areas where access to the internet is a challenge. The collection of data for this research was guided by the major concepts of Structuration Theory. According to Giddens (1984) there exist structures that both facilitate and hinder human actions. There are structures of domination, structures of signification, and structures of legitimation, which are all shown in Figure 2.

5. Findings and discussions

This study sought to explain the experiences of university students' participation in virtual classes during COVID-19. These experiences were divided into how university students benefitted and were challenged by structures of domination, legitimation, and signification as they participated in virtual classes. The subsequent sections present both the benefits and challenges of participating in virtual classes during COVID-19. The section concluded with the suggested recommendations for improving the rate of transitioning from physical classes to virtual classes in future situations that are as life-threatening as COVID-19.

5.1 Benefits of participating in virtual classes during COVID 19

The university students were asked to choose to form a list of items in Table 1, those that they think appropriately described how they think were the benefits of participating in virtual classes during COVID-19. Table 1 presents a list of benefits of online learning that were adapted from Patricia Aguilera-Hermida (2020). The university students had to choose from the list of choices regarding the benefits that they experienced from participating in virtual classes during COVID-19. The findings revealed that top on the list of benefits is "Learning was flexible" chosen by 90 participants.

Table 1: Benefits of virtual classes as experienced by university students

Benefits of virtual classes	
Benefits of virtual classes	**Count**
Learning from the comfort of my home was fun	81
Learning was less stressful	78
I spent more quality time with the family	82
I had more time to sleep	68
Learning was flexible	90
Incurred fewer expenses	81
Had more time for my hobbies	14
I had the inner drive to achieve my goals	65
I feel that I experienced personal growth	80
I spent more time on my schoolwork	67
I had a better understanding of the learning goals	62
I was exposed to more technological tools	88
More time with family	82
More free time	64

Benefits of virtual classes	
Benefits of virtual classes	**Count**
More control of learning	70
Better time management	84
More convenient	77
I gained new skills	88
I spent more time on my schoolwork	67
More time to study	75

These findings concur with existing literature, which acknowledges that e-learning tools provide learners with learning flexibility (Dhawan, 2020; Bdair, 2021b; Korkmaz and Toraman, 2020; Mukhtar *et al.*, 2020; Maatuk, 2022). It was interesting to note that the university students did not find virtual classes to promote their hobbies since this benefit was the least chosen with only 14 respondents who selected it. The overall results, however, show that virtual classes had a positive effect on university students as they indicated that they had more time to study, developed technological skills, they found learning to be fun and convenient among other benefits. These benefits clearly indicate that university students appreciated the intervention of virtual classes when physical classes had become almost impossible. The virtual classes were made possible by the existing structures, which facilitated the continuation of education during the COVID-19 pandemic. These structures included the family structures, which provided the technological, financial, and emotional support needed for successful participation in the virtual classes. The university structures facilitated the environment for online courses. The social structures motivated continuity in the virtual classes. Although these structures facilitated participation in virtual classes, the study also pointed to the challenges of participating in virtual classes, as are discussed in the subsequent section.

5.2 Challenges of participating in virtual classes during COVID-19

Like in the case of benefits, the participants were asked to select the challenges from the items listed in Table 2. The research participants identified several challenges that experienced while participating in virtual classes during the COVID-19 pandemic. The challenges included poor internet connectivity, expensive mobile data, lack of good communication with peers and lecturers, distractions from the environment, lack of familiarity with the online learning platforms, etc. It has been observed that many online learning platforms require a connection to the internet. This meant that the student must have access to the WI-FI or use mobile data, which the participants revealed that it was very expensive as is noted in Table 2 that 113 of the 150 participants experienced this challenge.

Table 2: Challenges of students' participation in virtual classes during COVID 19

Challenges of participating in virtual classes	
Challenge	**Count**
Mobile phone data was very expensive	113
It was difficult to connect to the internet	102
I could not easily consult with my lecturers	87
Too many distractions and background noises during online classes	88
There were too many isolated individual activities and expectations	13
It was difficult to do the project without direct physical assistance from the lecturer and the teaching/tutorial assistant	79
We scrambled for the shared internet connectivity with my parents and siblings	70
I could hardly interact with my classmates	77
I could hardly interact with my classmates	107
I missed discussing course topics with my friends	98
I was not familiar with the online learning platforms and technologies	65
The lecturers were not audible	17
I could not visit the library for additional learning material such as books and journals	77
Course practicals were not well demonstrated during the online lessons	76
I found my coursework more challenging	76
I missed more course announcements than usual	70
I struggled with the use of online discussions	69
Less classroom interaction	82

This was a significant finding because many students enrolled in undergraduate programs are not employed and they rely on their parents or guardians for financial assistance. Most importantly, like in other developing countries, the economic situation in the country is so bad that despite their willingness, the parents or guardians are not able to provide their children with money to purchase the costly mobile data to connect to the internet to facilitate their participation in the virtual classes. For example, Rahman, Uddin, and Dey (2021) identified costly mobile data and the poor economic situation of Bangladesh to be an inhibitor to the successful implementation of online learning during COVID-19. Similar concerns are acknowledged by Maatuk (2022) and Demuyakor (2020) who revealed that the students from Ghana, a developing country in Africa could not easily participate in online learning during COVID-19 due to the high costs of mobile data. Another challenge of interest that emerged from the collected data regards the boredom that the participants experienced during their participation in virtual classes during the COVID-19 era. This challenge was selected by 107, a 71.3% representation of the participants. This finding is also significant because, before the sudden emergence of the COVID-19 pandemic, the main mode of education in the country's education sector was face-to-face, where learners could attend physical classes and interact freely during or after the lesson. However, due to lockdowns brought about by COVID-19, the learners were to transition to virtual classes, an isolated environment with little or no interaction with both the teachers and core learners. This challenge concurs with existing literature, which shows that students usually find online learning to be boring and less engaging (Salakhova, 2022; Dhawan, 2020; Bdair, 2021; Patricia Aguilera-Hermida, 2020; Rahman, Uddin and Dey, 2021; Baber, 2020). It was however interesting to note that the absence of teamwork was not a major challenge for the research participants since only 13 respondents indicated the need for teamwork. This observation could be attributed to the fact that modern online tools can facilitate work collaboration remotely. It is therefore possible that the students could still work on projects and assignments as a team and remotely. More so another challenge of interest relates to the observation that the lecturers were less audible. Since this challenge was cited by only 13 respondents equating to a low representation of 8,6% of the total participants, this could be rather a problem of the network than a lecturer's problem. When asked to choose the most suitable mode of education, the participants opted for blended learning as it is indicated in Figure 3.

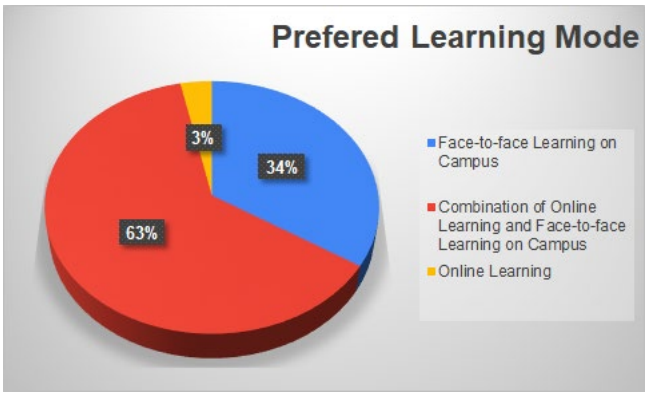

Figure 3: The participants' preferred mode of education

The representation in Figure 3 demonstrates that the participants were disappointed in the online learning method as it only had a 3% representation. The face-to-face method was not very popular as it had a 34% representation against the 63% representation of blended learning. It is, therefore, clear that the participants wanted to take advantage of the combined benefits of both face-to-face and online learning. Based on their preferences, the research participants were further asked to recommend strategies for improving the process of transitioning from physical classes to virtual classes. Their contributions are discussed in the next section.

5.3 Recommended strategies for transitioning to virtual classes during life-threatening situations

The research participants recommended several strategies that could be implemented to successfully transition from physical to virtual classes. These suggested strategies are demonstrated in Figure 4.

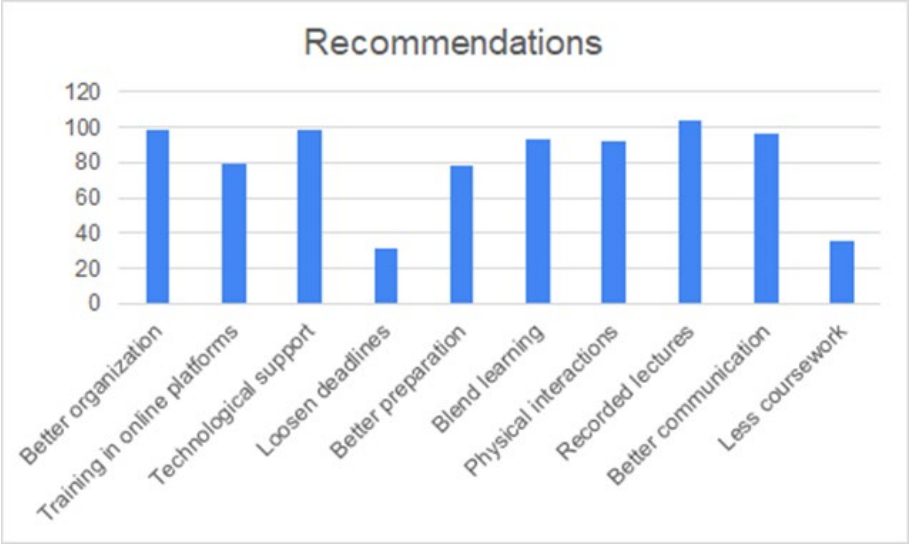

Figure 4: Recommended strategies for transitioning to virtual classes

Figure 4 displays the research participants' suggestions on how to improve the process of transitioning to virtual classes. The recommended strategies include better organisation of online learning (65,3%), training (50%), technological support (65,3%), flexible deadlines (20,6%), preparedness (52%), blended learning (62%), physical interactions (61,3%), use of recorded lectures (69,3%), better communication (64%) and less coursework (24%). These suggestions are supported by existing literature. For example, stakeholders' collaboration and cooperation are imperative for a smooth transition to virtual classes (Dhawan, 2020). On a similar note, Adedoyin and Soykan (2020) recommend that educational institutions collaborate with telecommunication industries to either subsidize the cost of internet subscriptions or provide free browsing data to the students and instructors as part of their corporate social responsibilities. Training on how to participate in virtual classes is also key to the success of transitioning from physical classes (Bdair, 2021; Al-Kumaim *et al.*, 2021; Korkmaz and Toraman, 2020). The need for proper organization and preparedness were also supported in existing literature as key aspects for transitioning to virtual classes (Widodo, Wibowo, and Wagiran, 2020; Dhawan, 2020; Mukhtar *et al.*, 2020; Adefuye, 2021). After considering the participants' recommendations and the support for those recommendations that are provided in the literature, the authors of this paper proceeded to propose a framework for transitioning from physical classes to virtual classes.

5.4 Proposed framework for transitioning to virtual classes during life-threatening situations

The analysis of both the recommendations of the research participants and the literature resulted in four themes for consideration in the framework for transitioning to virtual classes. These themes included resources, empowerment, adoption behaviors, and leadership, all of which are depicted in Figure 5.

According to Figure 5, Resources for use in the virtual class are influenced by the level of rate of acquisition, allocation, prioritization, and utilization. This means that the more the resources are prioritised, the higher the rate of their acquisition, and the higher the level of allocation leading to an increased level of utilisation. Empowerment depends on autonomy, authority, competence, and experience from using resources required for participating in virtual classes. This means that the absence of those elements hurts empowerment. The behaviours relating to the adoption of resources for participation in virtual classes rely on control, herding, attitude, and resistance. In the absence of resources and empowerment, control of resources is limited, leading to a negative attitude towards those resources, in turn, promoting resistance of virtual classes to result in a herding influence to abandon the virtual classes. It also emerged from the data for this research that leadership plays an important role in the transition from physical to virtual classes. These could be national leaders, institution leaders, or students' representatives. These leaders have a strategic role in the honest communication regarding the use of resources suitable for transitioning to virtual classes, the same leaders have a key role in the motivation to adopt resources and migrate to virtual classes. Those leaders have the power to establish a rapport with the industry and maintain a reputation that compels them to continue supporting the activities necessary for transitioning to virtual classes. The foundation assumption of this research is that a consideration of these key themes is a necessary condition for transitioning from physical to

virtual classes such that the presence of all those elements of the proposed framework could lead to a smooth transition to virtual classes while the absence of any element of the framework could result in a failed attempt towards virtual classes.

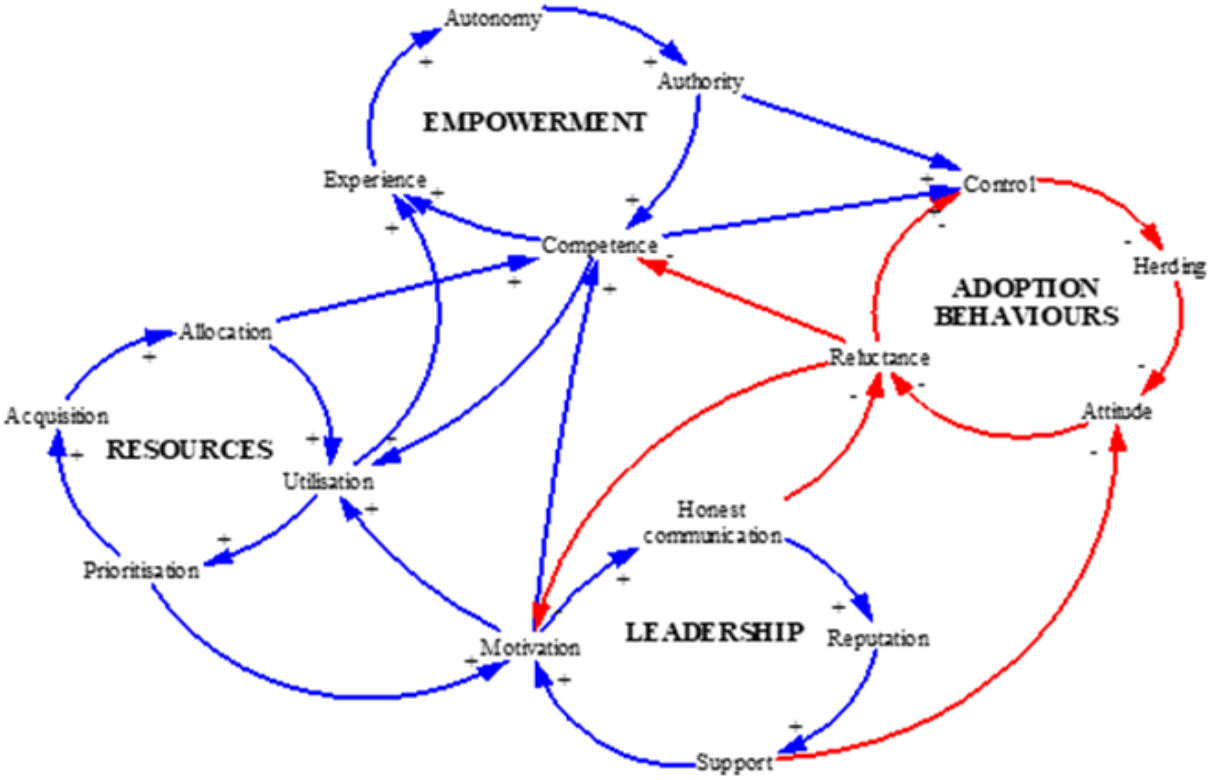

Figure 5: A Framework for transitioning to virtual classes, adapted from (Dube, 2020)

Data collection for this research was guided by the duality of structure involving structures of domination, signification, and legitimation (Giddens, 1984). On this note, this research argues *leadership* and *resources* are structures of domination with the power to facilitate or inhibit the transition from physical classes to virtual classes. *Competence* represents structures of signification because the presence or absence of knowledge of how to use resources suitable for participating in virtual classes can promote or hinder the transition towards the virtual classes respectively. Finally, the research concludes that *adoption behaviours* are structures of legitimation because the prevailing norms and moral conduct about education can either sustain the physical classes or motivate the transition towards virtual classes. The findings of this research, therefore, affirm that there exist structures of domination, signification, and legitimation, which either enable or constrain the smooth transition towards virtual classes. An understanding and consideration of these structures can therefore smoothen the process of transition from physical to virtual classes if need be.

6. Conclusion

The research sought to explain the experiences of university students regarding the benefits and challenges of transitioning from physical to virtual classes. The findings revealed that while the research participants acknowledged the benefits of virtual classes, they also experienced several challenges, which interrupted their smooth transitioning to virtual classes during the COVID-19 pandemic. The challenges were linked to structures of domination, signification, and legitimation, whose existence hindered the smooth transition to virtual classes. Using the participants' recommendations and literature, the study proposed a framework for transitioning to virtual classes. The components of the framework included leadership, resources, empowerment, and adoption behaviours, which together could improve the rate of transitioning to virtual classes. This research was however limited by a small sample taken from students enrolled in only two programs of a single university case. The research was also based on quantitative data only, which were collected during vacation making it difficult to follow up on students for participation in the research. Future research could expand the sample size and even comparative study based on multiple cases as well as collect

not only quantitative but also qualitative data for more insight into the lived experiences of students' participation in virtual classes during life-threatening situations.

References

Adedoyin, O.B., and Soykan, E. (2020) 'Covid-19 pandemic and online learning: the challenges and opportunities, *Interactive Learning Environments* [Preprint]. Routledge. Available at: https://doi.org/10.1080/10494820.2020.1813180.

Adefuye, A. O., Adeola, H. A., & Busari, J. (2021). The COVID-19 pandemic: the benefits and challenges it presents for medical education in Africa. *The Pan African Medical Journal*, *40*. https://doi.org/10.11604/pamj.2021.40.42.28489

Aguilera-Hermida, A.P. *et al.* (2021) 'Comparison of students' use and acceptance of emergency online learning due to COVID-19 in the USA, Mexico, Peru, and Turkey, *Education and Information Technologies*, 26(6), pp. 6823–6845. Available at: https://doi.org/10.1007/s10639-021-10473-8.

Al-Kumaim, N.H. *et al.* (2021) 'Exploring the Impact of Transformation to Fully Online Learning During COVID-19 on Malaysian University Students' Academic Life and Performance', *International Journal of Interactive Mobile Technologies*, 15(5), pp. 140–158. Available at: https://doi.org/10.3991/ijim.v15i05.20203.

Baber, H. (2020) 'Determinants of students' perceived learning outcome and satisfaction in online learning during the pandemic of COVID19', *Journal of Education and e-Learning Research*, 7(3), pp. 285–292. Available at: https://doi.org/10.20448/JOURNAL.509.2020.73.285.292.

Bdair, I.A. (2021) 'Nursing students and faculty members' perspectives about online learning during COVID-19 pandemic: A qualitative study', *Teaching and Learning in Nursing*, 16(3), pp. 220–226. Available at: https://doi.org/10.1016/j.teln.2021.02.008.

Demuyakor, J. (2020) 'Coronavirus (Covid-19) and online learning in higher institutions of education: A survey of the perceptions of ghanaian international students in China', *Online Journal of Communication and Media Technologies*, 10(3). Available at: https://doi.org/10.29333/ojcmt/8286.

Dhawan, S. (2020) 'Online Learning: A Panacea in the Time of COVID-19 Crisis', *Journal of Educational Technology Systems*, 49(1), pp. 5–22. Available at: https://doi.org/10.1177/0047239520934018.

Dube, S. (2020) *A Paradox of the Second Order Digital Divide in Higher Education Institutions of Developing Countries: Case of Zimbabwe*. University of Cape Town.

Giddens, A. (1984) *The constitution of society: Outline of the theory of structuration*. Los Angeles: University of California Press. Available at: https://doi.org/10.1007/BF01173303.

Korkmaz, G. and Toraman, Ç. (2020) *www.ijtes.net Are We Ready for the Post-COVID-19 Educational Practice? An Investigation into What Educators Think as to Online Learning*, *International Journal of Technology in Education and Science (IJTES)*. Available at: www.ijtes.net.

Lemay, D.J., Bazelais, P. and Doleck, T. (2021) 'Transition to online learning during the COVID-19 pandemic', *Computers in Human Behavior Reports*, 4. Available at: https://doi.org/10.1016/j.chbr.2021.100130.

Maatuk, A.M., Elberkawi, E.K., Aljawarneh, S. *et al.* The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors. *J Comput High Educ* 34, 21–38 (2022). https://doi.org/10.1007/s12528-021-09274-2

Mukhtar, K. *et al.* (2020) 'Advantages, limitations and recommendations for online learning during covid-19 pandemic era', *Pakistan Journal of Medical Sciences*, 36(COVID19-S4), pp. S27–S31. Available at: https://doi.org/10.12669/pjms.36.COVID19-S4.2785.

Mutunhu, B., Chipangura, B., Twinomurinzi, H. (2023). A Systematized Literature Review: Internet of Things (IoT) in the Remote Monitoring of Diabetes. In: Yang, XS., Sherratt, S., Dey, N., Joshi, A. (eds) Proceedings of Seventh International Congress on Information and Communication Technology. Lecture Notes in Networks and Systems, vol 448. Springer, Singapore. Available at: https://doi.org/10.1007/978-981-19-1610-6_57

Octaberlina, L.R. and Muslimin, A.I. (2020) 'Efl students perspective towards online learning barriers and alternatives using moodle/google classroom during covid-19 pandemic', *International Journal of Higher Education*, 9(6), pp. 1–9. Available at: https://doi.org/10.5430/ijhe.v9n6p1.

Patricia Aguilera-Hermida, A. (2020) 'College students' use and acceptance of emergency online learning due to COVID-19', *International Journal of Educational Research Open*, 1, p. 100011. Available at: https://doi.org/10.1016/j.ijedro.2020.100011.

Rahman, M.H.A., Uddin, M.S. and Dey, A. (2021) 'Investigating the mediating role of online learning motivation in the COVID-19 pandemic situation in Bangladesh', *Journal of Computer Assisted Learning*, 37(6), pp. 1513–1527. Available at: https://doi.org/10.1111/jcal.12535.

Salakhova, V. B., Shukshina, L. V., Belyakova, N. V., Kidinov, A. V., Morozova, N. S., & Osipova, N. V. (2022). The Problems of the COVID-19 Pandemic in Higher Education. *Frontiers in Education*. https://doi.org/10.3389/feduc.2022.803700

Vincent-Lancrin, S., C. Cobo Romaní and F. Reimers (eds.) (2022), *How Learning Continued during the COVID-19 Pandemic: Global Lessons from Initiatives to Support Learners and Teachers*, OECD Publishing, Paris, https://doi.org/10.1787/bbeca162-en.

Widodo, S.F.A., Wibowo, Y.E. and Wagiran, W. (2020) 'Online learning readiness during the Covid-19 pandemic', in *Journal of Physics: Conference Series*. IOP Publishing Ltd. Available at: https://doi.org/10.1088/1742-6596/1700/1/012033.

Autoethnographies: Academics Experiences and Lessons Learned From the Pandemic. Reshaping Academic Ways of Being and Doing

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Abstract: After a critical review of the impact of change on people's lives, we report on an empirical study highlighting three major aspects of academic life that the pandemic affected, providing supporting examples. The method used is first textual analysis for the critical review based on what the literature identifies as difficulties brought about by change (CBIA, 2022; Senge, 1990). The empirical study is of a qualitative nature (Creswell, & Poth, 2018) based on the analysis of observations in a personal journal, and aims at uncovering academic concerns during the pandemic. The findings will be valuable to academics to reshape their 'new normal'. Results include for the theoretical part of the literature review the fact that change impacts people and one cannot come back to prior positioning. Several findings from the analysis of the observational notes are centered around three main areas. The first issue was due to the short time span for new implementations and hence no time for foresight. This encompasses consequences of trial and error, more administrative control, and uncertainty of outcomes with contradictory discourses been held. Added to that there was a human cost that far exceeded what would normally be the case. For instance academic colleagues quitting or retiring early, unevenness in support provided, isolation in some cases compared to overabundance of support in others, perhaps even favoritism. The third major observation pointed to consequences on the instructional context. In this case, a number of positive outcomes were noted. More effort was placed on student engagement and learning, and it was all made visible. More activities were devised based on gaming strategies, and serious work was made more motivating. A better feel for knowledge integration was possible due to on-line learning for students who put some effort into it. Some observations however led to drawing conflicting conclusions. Finally, we discuss new future pathways. For instance, it is important to develop self-regulation in students and resilience for all concerned. There also appears to be a need to provide active support to everyone on an on-going basis as we move past the crisis.

Keywords: the impact of change, moving past the crisis, contradictions and conflicts, instructional and people outcomes

1. Introduction

Many people left their profession during the pandemic without any intention of returning to their position. This problem is acute in North America as is evidenced by CBIA (2022), "Our labor shortage is a full-blown crisis-we have 110,000 job openings, yet our labor force losses since the beginning of the pandemic represent an astonishing 10% of the national decline". People have a hard time coping and especially those who were already negatively impacted by their jobs before COVID 19. As a more specific example, there is a large teacher shortage in Canada, due mostly to burn-out. Labelle (2021) uncovered that Canada needs 10,000 teachers just to cover demands in the French Immersion programs. French teachers especially seem to be more susceptible to burn-out according to Viswanathan (2019) and the pandemic did not help this fact as teachers had to suddenly start teaching online without prior notice nor time to adjust.

In the academic context, change during the pandemic, especially with the back and forth from face to face to online teaching created tense moments for everyone, and people lacking resilience and self-efficacy skills (Bandura, 1997) were more affected by these somewhat chaotic situations. Compounding the difficulties was the fact that no real help was available with the switch to online teaching due to regulation imposed.

Senge (1990) expands extensively on the impact of change in normal circumstances. Given the added stress due to the pandemic, some personal situations became very strained.

When in addition people are facing inconsistent discourses, the problems look more challenging as it is impossible to know what decision is the right one to make.

All while perhaps thinking of being helpful, with maybe the best intentions at heart, a number of contradictory strategies were implemented at different levels by administration, adding more possibilities to lead astray. Nevertheless, thanks to Faculty and Staff members' good will and innovative thinking as well as positive actions taken, results were not as devastating as they could have been. However, two of my colleagues though retired at the end of year because of the problems caused. So, the question is regarding how far we have come with accepting this new normal. The new normal refers to the aftermath of the COVID 19 pandemic. A new normal

refers to a state following a crisis when the situation in which people find themselves is different from the one at the beginning of the crisis. The expression was used after World War I (Wise Wood, 1918) and subsequent crises.

The overall methodological approach is qualitative. The method used first is textual analysis for the critical review based on what the literature identifies as difficulties brought about by change (CBIA, 2022; Senge, 1990) finding the appropriate meanings and contextual implications. We examined the context of change by looking at the structure, content and meanings in research on change and its implications, more specifically, the underlying cultural and ideological aspects and how they were connected to the particular way the texts were produced.

The empirical study is of a qualitative nature too (Creswell, & Poth, 2018) based on the analysis of observations in a personal journal and aims at uncovering academic concerns during the pandemic. This study is of an autoethnographic nature. The research used self-reflection to write about anecdotes and personal experiences in a wider context to provide underlying meaning making. Authors (Ellingson, & Ellis, 2008) have come to the conclusion that various applications of autoethnography are making it difficult to clearly define it. Due to a focus on personal experience and subjectivity, a conscious effort was made to tell a story to add to existing knowledge. Although this knowledge is situated and can be contested, it provides insight into an experience. The researcher made every effort to tell the story in good faith.

The findings will be valuable to academics to reshape their 'new normal'. In this process the researcher looked into details to identify text units and categorize them for classification. The analysis aimed at uncovering details to interpret embedded meanings and to reflect upon the context and the themes in the data. Then connections were established, and understandings uncovered. In doing so the researcher combined knowledge from linguistics and semiotics.

Other limitations stem from the fact that the time frame for Senge's seminal work on change much precedes the time frame of the very recent journal entries on classroom observations. In retrospect the researcher feels that having in addition used literature on curriculum change could have brought about another dimension. However, usually researchers in curriculum innovation refer to innovation theory, perhaps not so useful here as the change that happened to people in the context of this research was not a planned change.

The study being of a qualitative nature does not allow to generalize results. Although the researcher tried to take distance from the data, regularly questioning whether there was any possibility of bias and trying to be as objective as possible, there could still have been a certain amount of subjectivity influencing the results. In an attempt at interpreting and evaluating hidden messages, the journal entries were also written, and a preference for certain ways of interpreting the data show. Nevertheless, the initial journaling took place as a regular routine and this before and not even having any idea that the journal could serve to develop a research study on the topics of interest here.

The background for the analysis is based in systems thinking (Senge), a process that is supposed to be balanced with delay as reflection is required. This is a simple cycle where an action in one direction eventually causes a reverse effect on the same variable. It is interesting because the delay frequently makes people overreact when their first action appears to be ineffective.

In our situation there was no time to delay anything, after weeks of in-person teaching suddenly teaching was mandated to be online only, followed again with in-person teaching and subsequent on-line teaching with a quick turn-around and quick on the spur of the moment decision making. This involved shifts in class preparations, changes of mindsets, removal of human contact among other aspects.

2. Theoretical underpinnings

Senge's (1990) thinking about organizational change is key in situations of rapid change, uncertainty and increased complexity as what was happening with COVID 19. However to be able to cope, the change mindset already should be in place, otherwise necessary delays for implementation will also cause havoc. Learning organizations have to change adaptively in response to problems, and based on collaborative insight and shared values. Open dialogue is necessary for new implementations. According to Senge, the five areas that should be

under scrutiny are: 1. Personal mastery, entailing honest reflection and evaluation for the purpose of identifying individual and organizational shortcomings, strengths, needs and goals. The ability to know oneself; how one reacts to situations and people. The ability to see how one's beliefs affect their environment. Being open to change and new ideas. Having a personal vision that causes internal tension and a desire to change and move in new directions. 2. Mental Models, having to do to with the explicit understanding of an otherwise implicit personal and organizational assumptions, biases, schemata, points of view, and so on. Love of truth and openness are the goals to shoot for in this discipline. Understanding that we all have mental models and willingness to examine our own along with those of the organization. 3. Shared Vision, pointing to the practice of clear definition and more important, enactment of guiding principles and aspirations. Connecting people by generating visions that integrate personal vision for life and for the organization into an organic, living whole. 4. Team Learning, i.e. the practice of collaborative learning and supportive group inquiry. The practiced discipline of learning together, developing the best plan for the group. Having true dialog amongst colleagues. Increasing the collective intelligence above that of any one person in the room with the view that the whole is greater than the sum of its parts. 5. Systems Thinking, corresponding to the powerful holistic approach to viewing organizational behavior. This is the ability to see the patterns behind any behavior, whether it is in a unit or on a much more personal level.

Senge spends a lot of time describing the idea and giving examples of how systems thinking provides leverage to make significant changes. The author also defines several archetypes of systems that he encounters over and over again. The basic cycles are balancing processes and reinforcing processes.

These theoretical underpinnings are aimed at developing three core learning capabilities: fostering aspiration, developing reflective conversation, and understanding complexity.

Systems thinking involves a fair amount of complexity, according to Luhmann (1984) and the author shows how we need to reduce complexity in order to be able to handle it in social systems.

Systems thinking implies the study of how individuals deal with groups, how groups of different sizes operate as social constructs, and how those groups operate together, and how those groups operate with technological systems. It highlights the feedback loops between the different groups or sets of technology.

One strategy advocated in change research (Senge) is to make the problem go away temporarily, however this was not possible with the mandate to teach online due to COVID. And neither was the strategy to let the goal to teach online slip. There was no other possibility than teaching online or cancel teaching.

Another process recommended is to go to the heart of the problem but that takes time, so that it was easier to use a temporary fix. In our situation the temporary fix was to hire some additional staff to help out, in fact quite a number of them. As noted in change theory, this caused a side reinforcing process that adversely affected the ability to find a better long-term solution. In fact, there was no visible impact of support provided by these people to instructors. In addition, these persons added to the financial burden of the unit.

It appeared that an attempt was made to shift the burden using balancing processes to affect the problems, another strategy advocated. Added technical support was provided in some cases. However, this did not fix the problems as some people did not start engaging with the technology themselves and as teaching moved from online to face to face several times nothing was achieved through that temporary help. Nevertheless, the strategy to shift the burden to Faculty members was a better idea by offering short course modules on technology in the classroom.

It appears that the strategy ‘success to the successful’ was used as some Faculty members were given more time to work on other projects and a lesser teaching load. This practice does not however fit within the goals of equity and inclusion of the unit. First, it appeared to be a reaction to the fact that some Faculty members had been given some administrative duty to lighten their online teaching burden, with additional demands made to administration and second, only relatively new Faculty members were appointed to these, not necessarily the best choices. There could be grievances filed on the choices made especially because there was no advertising for such positions. This could also spin into the ‘tragedy’, another process identified in change, that more and more people want to be in this kind of situation. Administration might not have seen it happen, but now in our

new workload agreement, we are requesting a half course teaching release for everyone to even the field, this is a direct outcome of decisions made.

In an attempt to reduce complexity in order to be able to process it (Luhmann, 1984), choices have to be made and some steps intended as solutions might fail. The authors (Senge; Luhmann) warn us that easy fixes can also cause long-term problems. Growth is also supposed to be somewhat controlled or limited through balancing cycles. It becomes more problematic if the balancing cycle involves shifting the burden. Researchers advocate more than one balancing loop to remain on the safe side.

Needless to say that during the pandemic, many valuable strategies went out the window and there appears to be a much greater crisis ahead of us.

Clearly, real systems are complex beyond description and the idea behind the proposed strategies had been to minimize the impact of change on people's lives. Today everyone is hanging by a thread. After the removal of mask mandates people expressed their relief and commented about the difficult times through which they went. More recently, the University, aware of the needs of personnel, has issued a recommendation for the maintenance of or for regaining wellbeing, to not use computers outside our work hours. The statement did not include the option of working less.

Thankfully, in higher education Faculty members' minds are mainly focused on student learning and research, however other areas were dealt with in a crisis management sort of way.

3. Discussion

Several findings from the analysis of the observational notes are centered around three main areas, namely time limitation, human cost and impact on instruction.

The first issue was due to the short time span for new implementations and hence no time for foresight. This encompasses consequences of trial and error, more administrative control, and uncertainty of outcomes with contradictory discourses been held.

Not only did instructors have to learn on their own how to use zoom, but they also had to adapt course delivery to the new modalities. Despite the fact that I had already engaged in reverse pedagogy for several years, translating the approach unto on-line still presented a number of challenges and trial and error.

In an attempt at providing support with technology, the administration grouped instructors into technology sessions with graduate students as instructors. These groupings were carried out by administration and there was a deliberate choice made for what members were included in different groups, which I found very offensive. Topics covered appeared to have been picked by the students, or so it was made to appear. These were mostly around using the platform administrators wanted instructors to use, on the Faculty Internet site, a platform that from my research did not present the advantages I was looking for. However, it allowed more control over discussion entries as courses were concerned on the part of the students and perhaps witnessed by administrators who had access. It probably was also an open forum for criticism of course content and instruction.

In addition, where these graduate student instructors were concerned, the offer to answer our questions and select topics for the following meeting, was not met with effective feedback. I had asked to find out about more features for the use of the whiteboard, and my question was never addressed so I ended up trying it all on my own which was also time consuming and required additional effort.

The meeting time had been set and in my case was very inconvenient, nevertheless as I hoped to gain some further insights, I bent over backwards to ensure I attended. Colleagues progressively opted out of the meeting series. No doubt were they made to feel just as I was feeling. In a friendly sort of way, the students appeared to want to impose some measures or else were limited in their knowledge, only dishing out what they knew.

Since there was no time for delay, as per Senge's recommendation, there could not have been more preventative thinking going on. Despite that, administration could have listed times for students' technological modules

offered and since these were given on-line there were no limits as regards the numbers of people signing in to different workshops. Perhaps there also was duplication of effort if all the different student teams were delivering the same content to all the different instructor groups. Moreover, in such a context of dire need and high stress levels, it would have been beneficial if instructors could choose to attend the modules with people who delivered the instructions in a way compatible to their learning and other needs.

Moreover, in addition to the uncertainty of outcome already weighing heavily on everyone and despite the added pressures, administration still imposed course end evaluations by students.

Added to that, as a second major problem, there was a human cost that far exceeded what would normally be the case. For instance academic colleagues quitting or retiring early, unevenness in support provided, isolation in some cases compared to overabundance of support in others, perhaps even favoritism.

A substantial number of mix-ups resulted from decisions made and where some requests for accommodations were supported others were denied.

Two valued colleagues quit last year as they felt overwhelmed by added demands and the lack of support provided. Support personnel also left. A retirement party we organized included nine people leaving whereas normally only two to three retire per year. In most cases people felt overwhelmed or not supported. Wellness support measures were attempted, however these mostly consisted of meetings without follow-up. The latest decision made was directing University members not to access their computers during off hours. There is so much demand on our time by meetings and other responsibilities during regular hours that it is close to impossible not to work on research projects and publications during uninterrupted times. As well, our graduate students request our time when they feel they need us. Not responding to them in a timely fashion is always frowned upon. With all these endeavors people feel caught between a rock and a hard place, not knowing what to do.

There was no easing-up on responsibilities, and it appeared that measures taken were more in the spirit of divide and conquer rather than providing support and warmth. When colleagues reached out to me, they shared their concerns and were looking for emotional support. Most of my experienced colleagues already had a full plate and additional expectations from administration added to their burden.

The Faculty union administration was not effective at supporting some members, it actually sounded that they got railroaded by a certain group of which members were a majority on the union administration. I felt personally harassed at times by the very people who were supposed to support me and mostly my requests ignored and put on the back burner.

A sizeable number of new staff members were hired, it is however unclear where they are and what they are doing. Therefore, it appears that staff is mainly supporting administration, yet their presence is not felt by ways of easing demands on Faculty members at large. No one has offered me more help in any area. Everything now has been moved on-line, including budget request, health claims, all other personal data access, anything having to do with research grants, course postings etc. I am required to do it all by myself and yet there are these new staff helpers available to someone somewhere in our unit.

Moreover, there is definite unevenness in support. Some new colleagues appear to have been given exceptional favorable working conditions with added administrative components and course release. Three more assistant dean positions were created and given to new Faculty members. There was no announcement for these positions nor were there competitions and interviews. On the other hand, buzz words like equity, diversity, inclusion among a few others are claimed to constitute the fabric of our university context. People have never been more divided as was acknowledged by colleagues of the Good and Welfare committee who are trying to do something about it. However, their requests for input from administration as to guidance regarding where to intervene has been met only with silence.

Interactions with colleagues became minimal and the lack of this socializing aspects took a toll on everyone, especially people without a family.

In addition, some special 'support' positions were created, but it appears that these only alleviated some people's workloads and in fact no significant help was noticed due to their creation, at least not in my direction.

The third major observation pointed to consequences on the instructional context. In this case, a number of positive outcomes were noted.

As in my teaching approach I already had used a flipped classroom approach, it was relatively easy to switch over to online teaching, as the students had a list of and links to all instructional materials to be prepared ahead of every class meeting. Without time and effort put on getting ready to come to class, as some students were seen on their beds and in pajamas during zoom meetings, they could redirect their effort to more constructive elements for improved learning. Some students kept their cameras off during whole class meetings. Nevertheless, during breakout room work, video cameras were put on, regardless of the situational contexts the students were in, this indicated the comfort level reached within the groups. As well, time saving elements were afforded the instructor, I developed the courses further to place more effort on student engagement and learning (Renninger & Hidi, 2016), and it was all made visible. Students were asked to provide a list of three things they learned, two questions or new things they wanted to know and one innovative idea.

More activities were devised based on gaming strategies. Assessment had to be more innovative as it was somewhat more difficult to really judge everyone's capabilities through group work in breakout rooms mostly. As well, as group assignments constituted most of the work to be handed in as initially described in the syllabus, there was little space for individual work to have an impact on overall final grading. I added points for creativity when students thought of new ideas and approaches, and for originality, if the students created with a unique style and produced something with a new twist. Some students did not understand that they could be creative but were not original. They conflated the two meanings, which caused difficulties in a few cases. Although the new trend in Ministry of Education guidelines is toward collaboration in group assignments, it appeared that in some cases only the cooperation model was used which in a way defeated the purpose of the intention of creating a community of practice (Lave and Wenger, 1991; Wenger, 1998)

A better feel for knowledge integration was possible due to on-line learning for students who put some effort into it. In fact, during breakout room activities, they asked each other questions for clarification and both those who asked and more so those who tried to provide explanations increased their learning, in the latter case through a deeper anchoring of concepts.

Some observations however led to drawing conflicting conclusions. Without the socializing component before and after classes as was the case during face-to-face meetings, students sometimes used class time to divert from the topics under scrutiny. This was noticed upon entering breakout rooms when the discussion stopped. However, in several cases students connected discussion topics to their own experiences during their school practicum placements, a good way to connect theory to praxis.

Participation in group work in breakout rooms had to be modified to require a product each time. In addition, each breakout room session had to be devised to make it more interesting. Thus, very active participation yielded excellent output.

Overall, group work for assignments was very effective and results were often superior. For individual work, although results were overall excellent there were some discrepancies and especially two cases of students who were procrastinating continuously but finally handed in superior work. It is possible that through the on-line work, they were able to glean more information over time and as a result when they finally completed their work they could include more of the instructor's feedback given on previously graded assignments. Student maturity also had a role to play in this as well as calculated decision-making.

4. Conclusion

It is clear that there were shifts in behaviors and adaptations to the new conditions, unfortunately with some still in the making and prevailing uncertainty.

We are still in a process of moving past the crisis. Overall unfortunately what we were witnessing post COVID corresponded to unwell, unhappy and demotivated employees, collective stress and a toxic environment, with

still static thinking exemplified, some rigid planning and processes still in place, top-down structures, silos, destructive internal competition and the self-serving syndrome being prevalent.

Active on-going support was needed for everyone around a change mind-set, those who did not get sufficient support could not cope and were left behind.

At all levels problem solving had to be fast. In fact, administrators used to crisis management had an advantage this time in these situations.

Nevertheless, it would be better for all concerned if instead of proceeding with a crisis management model, administration would learn to draw a larger and clearer picture of the workings of the organism that our Faculty is, but until now it doesn't look like they found the right pencil. I am at a Faculty of Education, already a 'learning organization' and there are attempts at letting some people expand their capacity on an on-going basis, in order to achieve their vision. Faculty level success does not need to create externalized complexities as sometimes appears to be the case, and it seems that present trends are of a more positive nature, with a coming together of minds (Olson, 2003). Increased sensitization during the difficult times while teaching online and being rather isolated seems to have created a culture of commitment to each other as Faculty members. We observed shifts in mindset, identified control patterns, and merged into a tighter, more congenial community of practice (Lave and Wenger, Wenger).

Despite all hurdles as far as instruction was concerned, the changes brought about some very positive outcomes. There was more transparency and all processes could be scrutinized more openly as one could not use the socializing often handy during in-person meetings, hence on-line teaching helped create a positive atmosphere to smooth over some other aspects with sometimes difficult questions been addressed.

References

Bandura, A. (1997) *Self-efficacy: the exercise in control*. W.H. Freeman and Company, New York.

CBIA (2022) "Employment report" [online] CBIA. https://www.cbia.com/news/media-releases/cbia-january-2022-employment-report/

Creswell, J. and Poth, C.N. (2018) *Qualitative inquiry & research design: choosing among five approaches.* SAGE, Thousand Oaks.

Ellingson, L., and Ellis, C. (2008). Autoethnography as constructionist project. In J. A. Holstein & J. F. Gubrium (Eds.), *Handbook of Constructionist Research*, 445-466. New York: Guilford Press.

Labelle, C. (2021) *Canada needs 10,000 teachers to address its FI teacher shortage*. Ottawa: Association canadienne des professionnels de l'immersion.

Lave, J. and Wenger, E. (1991) *Situated learning: legitimate peripheral participation*. Cambridge University Press, Cambridge UK.

Luhmann, N. (1984) *Social systems*. Stanford University Press, Stanford California.

Olson, D. (2003) *Psychological theory and educational reform*, Cambridge University Press, Cambridge UK. Renninger, K.A. and Hidi, S.E. (2016) *The power of interest for motivation and engagement*. Routledge, New York and London.

Senge, P. (1990) *The fifth discipline*. Currency, New York.

Viswanathan, U. (2019) Understanding the relationship between second language teacher beliefs and their instructional practices: a case study of core French teachers. *Canadian Journal of Applied Linguistics,* Vol. 22, No. 1, 26-59

Wenger, E.(1998) *Communities of practice: learning, meaning and identity*. Cambridge University Press, Cambridge UK.

Wise Wood, H. (1918). Beware! *N.E.L.A. Bulletin*, Vol.5, 604-605.

Development of Critical Thinking Disposition Using an Online Discussion Board During a Fully Online Course

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Abstract: Online discussion is a key learning activity for developing literacy of critical thinking disposition (CTD). The effectiveness and activities of online discussion during a blended learning setting have been analysed. The aim of this paper is to extract student's characteristics during online discussions in a fully online course in order to invite more participants to join and to encourage discussion. The differences in student's characteristics and learning performance between online discussants and non-participants were statistically analysed. Key characteristics were extracted and discussed using regression analysis. Also, causal relationship of the development of literacy of CTD were extracted and the learning progress of online discussants was examined.

Keywords: critical thinking, online discussion, student's characteristics, science and technology literacy, learning style

1. Introduction

The development of the critical thinking disposition (CTD) is essential when it comes to judging which information is accurate and reliable, and to having the ability to understand what the actual situation really is in any given instance. These skills and an appreciation of science and technology are necessary in modern society in order to be able to discern what is evidence and what is mis-informatation. (Rychen and Salganik, 2003; Nakayama et al. 2020). In particular, CTD ability and information processing skills are necessity in order to evaluate news about natural disasters and man-made calamities when speculative, biased or misleading tactics are used by the media. The development of these abilities is often necessary for the making of policies which can mitigate natural disasters. However, an appropriate educational methodology has not yet been established. As a study option, discussion activity may help students to be aware of the need to think critically in a blended learning course (Nakayama et al., 2019, 2018). The number of participants is limited by the opportunity for face to face discussion. As another option, bulletin boards or online communication tools may help to develop CTD ability (Kusumi and Tanaka, 2008; Leh et al., 2012; Ekahitanond, 2013; Trehan et al., 2017; Nakayama et al., 2019).

As essay writing ability may also contribute to CTD development, the authors have been studying essay reviewing activities (Nakayama et al. 2009; Nakayama et al. 2020). This approach is possible even with a large scale face-to-face class at a university or an online learning environment (Nakayama et al., 2021). The function of the online communication facility has been provided, but the activation of online discussion is not easily accomplished. Recent circumstances allow only online instruction and no face-to-face sessions. Another problem that has been recognised is how to invite participants to become involved in online discussions.

In this paper, the authors review certain aspects of online discussion for CTD development using metrics of student's surveys in an online course. The following topics will be addressed:

- (1) Scores of student's characteristics for online discussants and non-participants were compared during a fully online course.
- (2) Discrimination analysis of online discussants was conducted using the student's initial characteristics.
- (3) Causal analysis of development of critical thinking disposition using student's characteristic was conducted in order to illustrate the process of formulating CTD and learning performance.

2. Method

The development of CTD was observed during a regularly scheduled fully online course at a Japanese university, and was organised in an on-demand style (Nakayama et al., 2021).

2.1 Learning settings

The course was entitled The Psychology of Natural Disaster Mitigation and Prevention, and consisted of 15 sessions. Learning performance of participants was evaluated using several activities, such as weekly confirmation tests and report assignments.

The course has been organised as a fully online since 2020. The lecturer recorded videos of his lectures in advance, and the video clips for each session were delivered using the LMS. Therefore, all participants joined the course flexibly as off-campus students, and there was no face-to-face lecture room instruction. All communications such as assignment submissions, online tests, essay report reviews and follow-up surveys were conducted using the LMS. The learning performance was evaluated using online tests such as short writing tests which asked about course session topics and practices.

During the course, 341 participants responded to some of the surveys, and the valid number of participants in the analysis which follows was 252 in the 2021 course year.

Online discussion boards were available during the course, and all participants could join the discussions. The lecturer monitored student's postings and intervened when necessary. The number of valid discussants was 42.

2.2 Survey metrics

The following inventories were surveyed regularly during the course in order to summarise the characteristics of participants. Most metrics were measured continuously, as in previous studies (Nakayama et al. 2018, 2019, 2020, 2021).

2.2.1 Personality (Big5)

Scores of participant's personalities were measured using a shortened version of the Big5 inventories, which consists of 10 question items (Kawamoto et al. 2015). The factors which were extracted were Extroversion (P1), Conscientiousness (P2), Neuroticism (P3), Openness (P4), and Agreeableness (P5). The factor scores of the Big5 use 7-point scales (1-7).

2.2.2 Critical thinking disposition (CTD)

Hirayama and Kusumi (2004) developed a Japanese inventory of behaviour exhibited during development of critical thinking. Four factors from the inventory were extracted: Awareness of logical thinking (CTD-1), Inquiry-mindedness (Inquisitiveness) (CTD-2), Objectiveness (Objectivity) (CTD-3), and Evidence-based judgement (CTD-4). These CTDs were scored using a 5-point scale (1-5). These metrics were surveyed twice during the course as the first and the second halves. The differential scores between two surveys are also used in the following analysis.

2.2.3 Information-processing Style (IPS)

Personal styles of information processing and judgement were measured using the Rational and Intuitive Information Processing Style Inventory (Naito et al. 2004). Two factor scores, such as Rationality (IPS-1) and Intuition (IPS-2), were calculated using this inventory. These were also scored using a 5-point scale (1-5).

2.2.4 Literacy of science and technology (LST)

Kawamoto et al (2013) developed an inventory of science and technology literacy which is based on a survey of scientific literacy. It consists of 10 questions, from which four factors were extracted from the answers: Life-centered (LST-1), Sciencephile (people who are interested in science and technology) (LST-2), Logic-oriented (LST-3), and Authoritarian (LST-4). The LSTs were scored using a 4-point scale (1-4). Four clusters of LSTs were also defined in order to compare behavioural attitudes toward Social science issues using the four dimensional factor scores (Kawamoto et al. 2013).

2.2.5 Additional participant evaluation metrics

Participant's performance was measured using test results from each session of the course. These were defined as “Overall assessment scores”. Additional “Review essay assessment” scores were extracted in order to evaluate CTD ability by applying the IRT technique (Linn, 1989) to rating scores of participant’s reviews of 13 peer’s essays (Nakayama et al., 2020, 2021).

The participant’s essay reports were evaluated by the course lecturer using a rubric which was presented to participants in advance for the fairness assessment. The targeted essay assignment was a task for a session.

3. Results

3.1 Characteristics of online discussants

In order to extract typical characteristics of online discussants, surveyed metrics are statistically compared between the two groups. The results are summarised in Table 1. Means and STDs of factor scores in the two groups are compared. Since some surveyed data is missing, the overall number of individuals is reduced.

Table 1: Comparison of factor scores between participants of online discussions and non participants

	Online Discussion (mean, STD)		
Factors	Joined(N=32)	No(N=173)	t value
Extroversion	**4.4(1.7)**	**3.8(1.5)**	**2.1(*p<0.05*)**
Conscientiousness	3.4(1.4)	3.2(1.3)	
Neuroticism	4.5(1.2)	4.5(1.3)	
Openness	4.2(1.3)	3.8(1.3)	
Agreeableness	2.7(1.0)	2.8(0.9)	
Awareness of logical thinking	2.9(0.7)	2.8(0.7)	
Inquiry-minded	**4.1(0.6)**	**3.9(0.6)**	**2.3(*p<0.05*)**
Objectiveness	3.8(0.6)	3.7(0.6)	
Evidence-based judgement	3.6(0.7)	3.6(0.7)	
Life-centered	3.8(0.9)	3.5(0.8)	
Sciencephile	3.7(1.0)	3.5(0.7)	
Logic-oriented	3.5(0.8)	3.3(0.7)	
Authoritarian	2.9(0.9)	3.0(0.7)	
Rationality	**3.6(0.6)**	**3.2(0.6)**	**3.9(*p<0.01*)**
Intuition	2.9(0.6)	3.0(0.6)	

The differences in means between the two groups are examined using a t-test. In the results, three factor scores are significantly different, such as "Extroversion" of personality, "Inquiry-mindedness" of CTDs, and "Rationality" of information processing style. All means for online discussants are significantly higher than the means for non-participants. Some student's characteristics may affect student's behaviour during online discussions.

The composite factor scores may influence participant's learning activity. In a more detailed analysis, the differences are compared carefully, with consideration given to individual factor score patterns by using propensity scores and propensity score matching techniques to reduce the effect of individual factors (Hoshino, T. and Okada, K., 2006). As the result, there are no variables which present significant difference between the two groups. This result shows that the student's overall characteristics promote online discussion. This factor will be reanalysed in the following sections.

3.2 Learning performance analysis

Since attitude toward learning, such as the characteristics of students did not explicitly affect online discussion activity, conventional learning performance was analysed, such as knowledge-based session test scores for “Overall assessment scores”, lecturer's assessment scores for individual essay reports, and “Review essay assessment” scores. The “Review essay assessment” scores are generated using an IRT based graded response model and patterns of individual rating scores for each of the 13 essay reports.

Results of simple analysis show that “Overall assessment scores” may be a common assessment index. The relationships between the three measures are summarised in scatter grams in Figure 1. Figure 1(a) shows the

relationship between overall assessment and essay performance, and Figure 1(b) shows the relationship between overall assessment and "Review essay assessment" scores. Both correlation coefficients are relatively small, but significant coefficients such as *r=0.22* and *r=0.16* show that student's performance may depend on knowledge-based performance.

The coefficients are compared in Table 2, using upward-oriented triangles for coefficients of non-participants and downward-oriented triangles for coefficients of online discussants. The effect of the small sample size may influence the coefficients for online discussants, as their performance is independent of each other. If the progress of CTD development is affected by this independence, online discussants may acquire the attitude of critical reviewers during the course. The effect of sample size should be considered carefully.

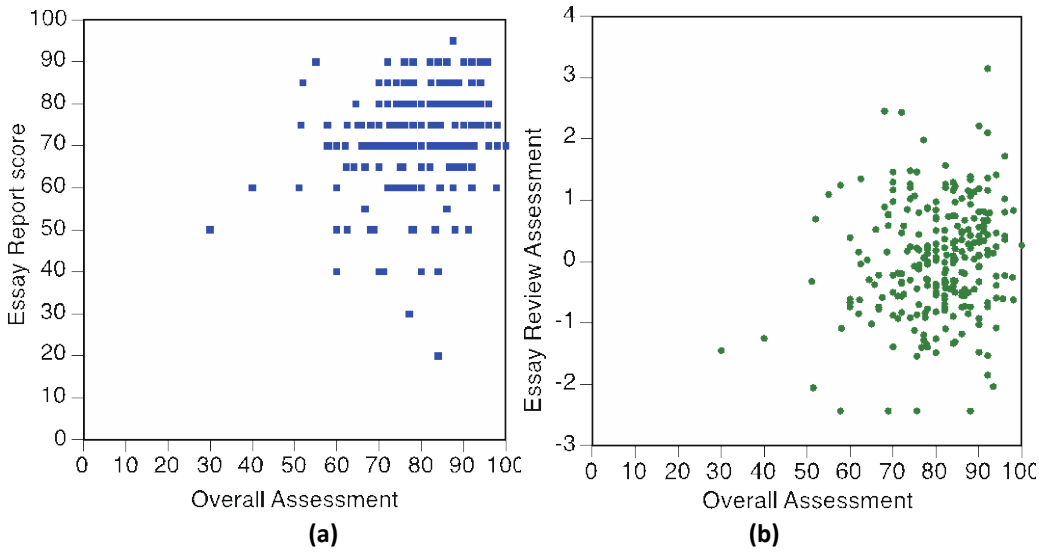

Figure 1: (a) Scattergram for overall assessment and essay report score (*r=0.22*); (b) Scattergram of overall assessments and essay review assessments (*r=0.16*)

Table 2: Correlation coefficient performance

	Tests	Report	Review rating
Tests		**0.17**	**0.21**
Report	*0.20*		*0.08*
Review rating	*0.13*	*-0.17*	
Non(N=212): Upper Angular, Joined(N=40): Lower Angular			

3.3 Features of online discussants

Once again, the features of online discussants are extracted using a logistic regression analysis which is a kind of discrimination procedure. In order to determine the features of individuals, analysis was conducted using a variable selection procedure.

In the results, 7 variables were selected as contributions of online discussants. They are summarised in Table 3. The selected variables are two personality scores, four CTD scores and the information processing style. The four selected CTD scores were surveyed at the beginning of the course. Therefore, all variables reflect student's initial attitudes. The positive weighted variables are Agreeableness and Objectiveness. These types of participants may have the potential to be online discussants. Also, other participant's characteristics may affect to join the online discussion. An appropriate procedure to invite their participation and contributions of participant's characteristic should be considered.

Table 3: Selected variables for detecting online discussants

Variables	Coefficient	SD Error	Pr>Chisq
Neuroticism	-0.29	0.21	0.16
Agreeableness	0.47	0.30	0.12
Awareness of logical thinking	-0.52	0.43	0.23

Variables	Coefficient	SD Error	Pr>Chisq
Inquiry-minded	-1.05	0.52	0.04
Objectiveness	1.17	0.45	0.01
Evidence-based judgement	-0.42	0.42	0.32
Rationality	-1.00	0.52	0.05

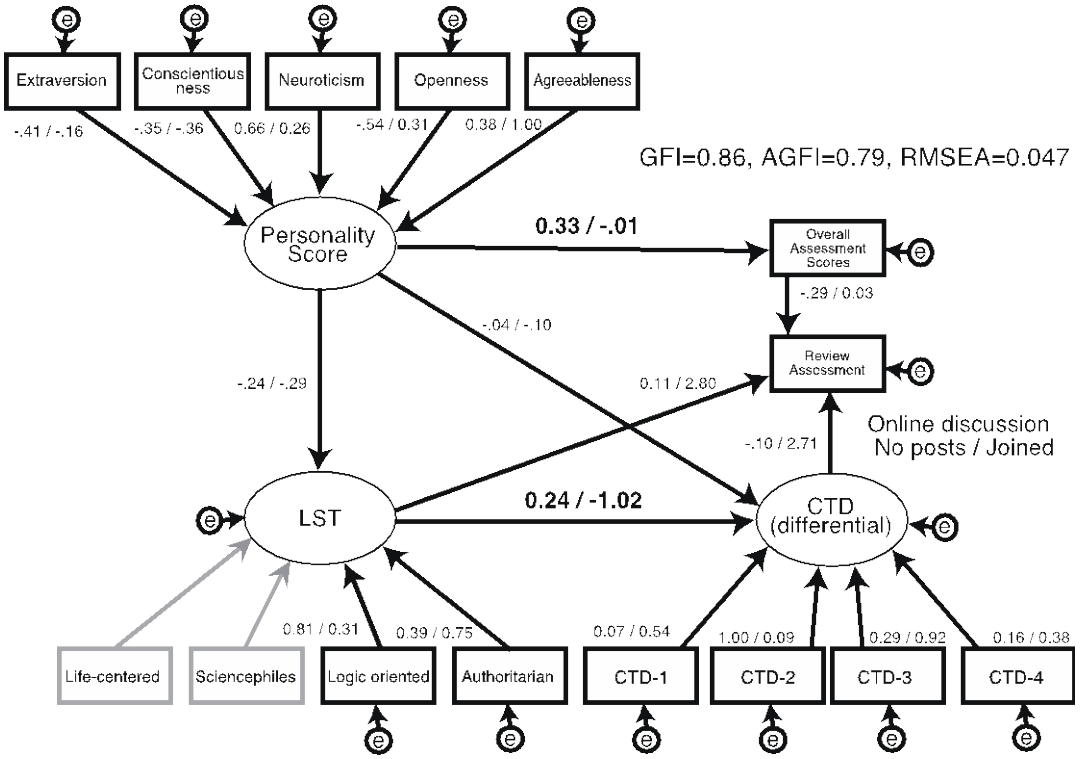

Figure 2: Causal relationship between student's characteristics (Personality and Literacy of Science and Technology) and development of critical thinking disposition for online discussants and non-participants

3.4 Causal relationship

The relationships between student's characteristics, CTD development and learning outcomes are compared using two online discussion groups, namely online discussants and non-participants. During the analysis, it may be possible to confirm whether those participating in online discussions are affected by CTD development.

In order to extract the relationships, a structural equation modelling technique was applied and the results evaluated using a causal relationship between them, as was done in the previous study (Nakayama et al. 2021).

The causal relationships were evaluated using indices of the fitness of the model (the GFI: Goodness of Fit index, AGFI: Adjusted GFI and RMSEA: Root Mean Square Error of Approximation) (Toyoda, 2007). Contributions of some factor scores were checked to optimise the model.

As a result, a possible causal path was extracted, as shown in Figure 2. The model was significant in regards to the evaluation indices (*GFI=0.86, AGFI=0.79, RMSEA=0.047*). The coefficients of path connections are compared between online discussants and non-participants. In a statistical test of coefficients, there are significant differences in "Personality Score" and "Overall Assessment Scores", and "LST" and "CTD (differential)". In both cases, the coefficients for non-online discussants are positive, and the coefficients for online discussants are negative. As mentioned in the above analysis, although online discussants have sufficient ability, their development during the class may be limited.

4. Summary and discussion

The purpose of this paper is to extract the differences in learning activities between participants and non-participants of online discussions in a fully online course. The survey consists of hierarchical analysis between two levels.

First, characteristics of course participants were compared between two groups using conventional metrics such as personality factors of Big-5, cognitive styles and literacy of science and technology (LST). The online discussants scored higher in factor scores for Extroversion of personality and Rationality of information processing style. The factor score for inquiry-mindedness of CTD for discussants is also significantly higher than for the non-participants. However, the use of another analytical approach did not find any significant differences in observed variables. The variables contributing to identification of online discussants were extracted, and consisted of the initial CTD factor scores, and some factor scores of personality and Rationality. The result suggests a factor pattern for identifying potential online discussants. The encouragement of the use of this procedure should be considered.

During the course, participation in session tests and the writing of essay reports were requested. Again, online discussants' scores are also significantly higher than those of others ($p<0.05$). In order to observe the reviewer's attitude toward the information presented, a set of 13 essay reports was used to evaluate and rate scores of each participant, and their assessment ability was estimated. The ability scores of the two groups were comparable, however. Also, the ability scores correlated with scores of session tests of non-discussants, but the relationship was not observed with discussants.

For the development of CTD, a causal relationship between these factors and test scores was examined using a SEM technique, and the differences in the two groups were examined statistically. In the results, there are significant differences in path coefficients of some paths, such as from personality to session test scores and from factor scores of LST to CTD.

A procedure that would attract the participation of more online discussants, and the assessment of its contribution to the development of CTD ability will be subjects of our further study.

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References

Ekahitanond, V. (2013) “Promoting university students’ critical thinking skills through peer feedback activity in an online discussion forum”, *Alberta Journal of Educational Research*, 59(2), pp. 247-265.

Hirayama, R. and Kusumi, T. (2004) “Effect of Critical Thinking Disposition on Interpretation of Controversial Issues: Evaluating Evidences and Drawing Conclusions”, *Japanese Journal of Educational Psychology*, 52, pp. 186-198.

Hoshino, T. and Okada, K. (2006) “Estimation of Causal Effect Using Propensity Score Methods in Clinical Medicine, Epidemiology, Pharmacoepidemiology and Public Health; A Review”, *J. Natl. Inst. Public Health*, 55(3) 230-243.

Kawamoto, S., Nakayama, M. and Saijo, M. (2013) “Using a scientific literacy cluster to determine participant attitudes in scientific events in Japan, and potential applications to improving science communication”, *JCOM*, 12(1), pp. 1-12.

Kawamoto, T., Oshio, A., Abe, S., Tsubota, U., Hirashima, T., Ito, H., and Tani, I. (2015) “Age and Gender Differences of Big Five Personality Traits in a Cross-Sectional Japanese Sample”, *The Japanese Journal of Developmental Psychology*, 26(2), pp. 107-122.

Kline, R.B. (2005) *Principles and practice of structural equation modelling, Second Edition*, The Guilford Press, New York.

Kusumi, T. and Tanaka, Y. (2008) “A development of critical thinking ability during a class of English for Specific purpose”, *JAEP annual meeting*, PF2-35.

Leh, ASC., Kremling, J., Nakayama, M (2012) “Effects of the Use of the blog and discussion board on online teaching and learning”, *Society for Information Technology & Teacher Education International Conference*, 574-579.

Linn, R. L. (1989) *Educational measurement, 3rd edition*, New York, USA: Collier Macmillan Publishers.

Naito, M., Suzuki, K. and Sakamoto, A. (2004) “Development of Rational and Intuitive Information-Processing Style Inventory”, *The Japanese Journal of Personality*, 13(1), pp. 67-78.

Nakayama, M., Kikuchi, S., and Yamamoto, H. (2021) “The development of critical thinking disposition during two online styles of learning”, *Proc. of ECEL 2021*, pp. 314-320.

Nakayama, M., Kikuchi, S., and Yamamoto, H. (2020) “Development of Critical Thinking Disposition During a Blended Learning Course”, *Proc. of ECEL 2020*, pp. 358-364.

Nakayama, M., Kikuchi, S., and Yamamoto, H. (2019) "Lexical Analysis of Online Discussion in a Blended Learning Course", *Proc. of ECSM2019*, pp. 223-230.

Nakayama, M., Kikuchi, S., and Yamamoto, H. (2018) "The relationship between student's characteristics and online discussion activity", *Proc. of ECEL 2018*, pp. 417-423.

Rychen, D.S. and Salganik, L.H. (2003) *Key competencies for a successful life and a well-functioning society*, Hogrefe & Huber Publishers, Boston, USA.

Toyoda H. (2007) *Kyo bunsan kouzou bunseki [AMOS HEN]*, Tokyo Syoseki, Tokyo, Japan.

Trehan, S., Sanzgiri, J., Li, C., Wang, R., and Joshi, R.M. (2017) "Critical discussions on the Massive Open Online Course (MOOC) in India and China", *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 13(2), pp. 141-165.

Improving Online Learning Design for Employed Adult Learners

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Abstract: With the growing need for developing competence at workplaces, the number of employed adult learners is increasing in higher education institutions to follow continuing education. Often they are educated and treated as traditional students. To satisfy the learning demands of employed learners, work-integrated education has emerged to spotlight the importance of the integration of work and education in contemporary education. Many studies show that employed adult learners have different and more complex ways of learning compared to traditional students. Furthermore, employed adult learners have lacked the attention of researchers and educators to enhance their learning in general and online learning in particular. Meanwhile, online learning is a preferred way for learners who work and study in tandem. This study aims to make the online learning design for employed adult learners more effective and adaptable to their circumstances by asking the research question "How can online learning design for employed adult learners be improved?". The case study of a course for employed adult learners was examined with a mixed method approach including interview and learning analytics. The interview data laid the groundwork for developing assumptions and hypotheses for the examination of employed adult learners' learning patterns. Learning analytics consist of data visualization, which revealed employed adult learners' learning patterns, and statistical tests, which inspected the validity and reliability of the patterns revealed by the log data. The log data were extracted from the learning management system, which recorded the educational activities of the learners during the course. This study exposed the pitfalls of the learning design including average to low engagement not only in learning but also in the course. As a result, the indicators to improve the online learning design for employed adult learners comprise investing in learning materials and increasing online interaction to fortify learner engagement in the course, thereby enhancing course completion. The indicators are viewed as the first step in the process of developing a proper and effective online learning design for employed adult learners. Finally, the reflection on online interaction for employed adult learners is also discussed.

Keywords: work-integrated education, employed adult learners, online learning design, online learning

1. Introduction

The provision and enactment of continuing education has become a hallmark of modern occupational development. This is because the requirements for remaining competent at work are constantly changing, particularly in developed countries, due to the globalization and the technology-driven world. There is a trend towards mature-age workers returning to educational institutions to update and enhance their knowledge. The responses to these educational provisions are performed in different ways from the approaches for students who are in entry level preparation for employment. Thus, lifelong learning and continuing education are becoming increasingly important, yet necessitate distinct educational provisions (Smith et al., 2013). To offer the distinguishing educational provision for employed adult learners (EALs), work-integrated education (WIE) has emerged to tailor the connection between workplaces and higher education institutions. The collaboration between employers and educators ensures that learners are offered new and accessible knowledge which is relevant to their workplace situations (Little and Brennan, 1996). In addition, WIE aligns the learning with the organization's goals and the individual's needs to reinforce organizational and personal growth. Regarding the learning of EALs, learning experience becomes a core that requires more attention (Billett, 2009).

Understanding EALs' learning experiences helps educators adjust learning designs to adapt to the circumstances and characteristics of EALs. According to Billett (2011), mature-age workers inferred the discomfiture when being treated as students with somebody teaching them. These workers had much to contribute to their learning while acknowledging that they needed to learn. Thus, a pedagogic approach was proposed, which was to engage with others in the form of a dialogue forum with other workers to share knowledge and experiences. Although exchanging knowledge through forums also exists in courses for traditional students, the forums for EALs need to be more proactive and robust to lead to the formation of learning communities. This is considered as a distinguishing feature in learning design for EALs.

Currently, learning design in higher education institutions has shifted towards online environments, not merely in traditional classrooms as before. This is to say that the concern in this paper is not simply a proper learning design for EALs, but also an effective online learning design for EALs. Smith et al. (2013) divulged that there was a preference for online and computer-based learning amongst EALs. Time is precious to EALs when they work and study at the same time. In addition, travel can be a considerable expense to them. As a result, it is not

strange when the majority of learners in distance courses are EALs (Bergman, 2012). The potential of digital technology to support and enhance teaching and learning is undeniable. Digital technology in particular facilitates EALs with flexibility in learning. However, the full capacity of technology in transforming teaching and learning has rarely been maximized in practice (Glover et al., 2016). Digital technology is even underutilized in continuing education for EALs (Short and Greener, 2014).

This paper strives to improve the online learning design to be more characteristic and appropriate for EALs through the case study of a hybrid course for employees from different companies at a Swedish university. The case study was investigated by interviewing the educator and using learning analytics to identify the limitations of the learning design through EALs' learning patterns in the learning management system (LMS). Relying on the limitations of the current learning design, the indicators for the online learning design improvement for EALs are set to answer the research question "How can online learning design for employed adult learners be improved?".

2. Online learning design for employed adult learners

The characteristics that students bring to online learning environments determine the success in online learning (Leeds et al., 2013). To understand the characteristics of adult learners, Frey and Alman (2003) and Cercone (2008) applied theories of adult learning to make recommendations for online learning design (Table 1). Although both papers concern adult learners in general, the adult learners in their studies are employed and show the typical characteristics of EALs. Thus, the results of these papers can be used to generalize the online learning design for EALs. The recommendations of both papers consider EALs' characteristics, circumstances, and learning. Regarding the characteristics of EALs, the limitations and individual differences are taken into account in these papers. Additionally, the traits in EALs' learning such as prior experience, interaction, flexibility, and support are accommodated here. There are similarities and different emphases in the recommendations of these papers.

Table 1: Recommendations for online learning design for adult learners

Cercone (2008)	Frey and Alman (2003)
1. Consider limitations of adults. 2. Consider learning styles due to individual differences. 3. Create opportunities for learners to be actively involved in the learning process. 4. Provide learner support. 5. Support in dealing with pre-existing learning history and working in the new learner-centered paradigm. 6. Act as a facilitator. 7. Help learners to connect new knowledge to prior experience. 8. Show the link between knowledge and how to apply it to their own lives. 9. Focus the learning on issues concerning learners and show how to conduct the learning. 10. Help learners test their learning in specific cases. 11. Create a collaborative, respectful, mutual, and informal learning climate. 12. Provide self-reflection on the learning process and support for transformational learning. 13. Provide dialogue and social interaction.	1. State clear expectations. 2. Incorporate multiple forms of feedback into courses. 3. Provide regular communication to individual learners and the group. 4. Provide learner flexibility and control. 5. Incorporate motivational strategies to encourage students. 6. Offer a variety of forms of learner support. 7. Maintain the focus of content within units. 8. Provide consistency among courses. 9. Consider limitations of adults. 10. Respect learner roles and life experiences.

3. Methods

Due to the complexity of EALs' circumstances, an in-depth case study of a course for EALs was conducted to understand EALs' learning and improve the online learning design for them. In this case study, a mixed method approach was used due to the necessary combination of qualitative and quantitative methods providing a better understanding of this research problem (Anguera et al., 2018). In the qualitative method, an in-depth interview was undertaken. In the quantitative method, learning analytics was performed with two sub-methods: data visualization and followed by statistical tests to test how reliable the observations on data are.

3.1 Qualitative method

Due to the unknown context beforehand, an in-depth interview was selected to find out more about EALs, their learning, and their course. The interview was conducted online with the educator of the course, and lasted

longer than one hour including note-taking, recording, and obtaining approval. The investigation inquired into pedagogical designs distinguishing the course for professionals from courses for traditional students, thereby determining to what extent the data was able to divulge the learning patterns of EALs. The initial interview questions included:

- Did you design the pedagogical elements in the course to support the context of the combination between the learners' workplaces and the educational offerings from the university?
- How were the pedagogical elements for EALs shown in the course (for example, through which educational activities, learning time)? Could the pedagogical elements for EALs be seen in the LMS?
- What did you expect from the students with respect to learning behaviors when you designed the elements for EALs?

Premised on the educator's responses, follow-up questions were asked to gain a better understanding of EALs.

3.2 Quantitative method

3.2.1 Data visualization

There were two systems from which data were extracted including Canvas LMS and the national grading system. The quantitative data include: (1) Canvas log data and (2) final results. Canvas log data contain learners' data about course page views, assignment submissions, discussions, and an access report. Result data from the national grading system encompass final results of the learners in this course. To prepare for the data extraction, permission from the company was obtained. Regarding data privacy, Student ID field was anonymized by hiding two digits when it was displayed in the charts. The URLs were mostly pruned and only the necessary content such as title and category name were shown. The titles are translated into English.

3.2.2 Statistical tests

The statistical tests were undertaken to test the validity and reliability of the observations on data after data visualization revealed the learners' learning patterns. Due to the small sample size, Fisher-exact test was used for the comparison of two independent proportions (Kim, 2016). The test examined a binary outcome (engage or not engage) obtained from two groups (the learners completing versus not completing the course) in the educational activities of submitting assignments, participating in discussion threads, viewing instruction files, recordings, and learning materials. The null hypothesis was formed based on the qualitative data.

4. Results

4.1 The case study of a course for employed adult learners

Through the interview, information about the course and the learners was investigated. The study was undertaken on an advanced level course in the Engineering department at a Swedish university. The course was particularly designed for EALs who were between the ages of 34 and 59 and employed in different companies. These companies ordered and paid for the course for their employees. Thus, the course syllabus and curriculum were built and developed through collaboration between the employer and the educator to adapt to working demands and individuals' needs. This course was selected due to the relatively varied educational activities that can be observed through log data. Following the national system of study results in higher education, there were nineteen learners registered for the course of which seven learners did not complete the course and the rest completed. There was no failed or low grade. The course was conducted in a hybrid form, signifying that on-campus lectures and seminars took place on one weekend and three other meetings took place in the online platform. The course offered 3.5 credits, equivalent to approximately ninety-three learning hours and lasted from the middle of December, 2019 to the end of March, 2020. The learners were expected to study on weekends, evenings, and in their spare time while still working full time.

4.2 The learning design of the course for employed adult learners

From the qualitative data, the pedagogical designs for EALs in particular were described, whereby an assumption about learning patterns was drawn as the basis to perform the next step of data visualization. A null hypothesis was set based on the assumption for the statistical tests.

There were the characteristic designs for the course for professionals. The first point was the provision of instructions and overview of the lectures and seminars beforehand, so the learners grasped the information and prepared for the imminent lectures and seminars. The educator additionally addressed that although the information was presented in the course plan at the beginning of the course, the learners could not afford to regularly check the course plan due to their full schedules. Thus, it was necessary to do so before every lecture and seminar. The second point was creating warm-up assignments before lectures to capture how the learners perceived and what they thought about after preparing and reading the literature. The assignments were not mandatory but were still expected to be submitted. The third point is the discussion activity which was conducted physically and virtually. The discussion threads were used for collecting information about the learners' backgrounds, their expectations for the course, their previous experience as well as opinions on specific topics. Although the discussion activity was not mandatory, the learners were expected to post their viewpoints in the threads. The fourth point was recording the lectures which were elective and uploading them to the course page, whereby the learners were able to watch them later in case they could not participate in the lectures. Moreover, there were three exams that the learners needed to do to complete the course. Two of them required submissions in the LMS and one was the presentation on campus.

According to the pedagogical designs for EALs, the assumption for the further examination on EALs' learning patterns is that "there is a correlation between engagement and course completion". Correspondingly, the null hypothesis for the statistical tests is "there is no correlation between engagement and course completion".

4.3 The learning patterns of employed adult learners

The study is followed, first by visualizing the activities of viewing instruction files, recordings, learning materials, participating in discussions, and submitting assignments (Figures 1, 2, 3, 4, and 5), and second by statistical tests for each activity.

Figure 1 alludes four instruction files ordered by time. The educator uploaded the files before the respective lectures and seminars. It is straightforward to see that learners completing the course viewed all or most of the instruction files while the learners who did not finish the course had two dispositions. Some viewed most or all of the instruction files while others viewed only the first file. From the chart, twelve learners completing the course and four learners who did not complete the course were presented, which means that three remaining learners who did not complete the course and were not presented in the chart, did not view any instruction files.

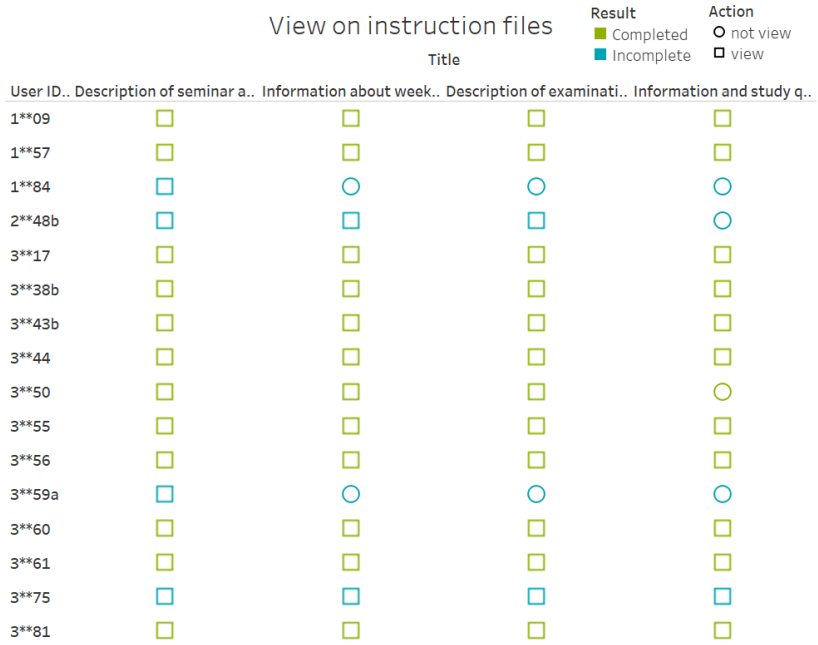

Figure 1: View on instruction files

Figure 2 presents the view on recordings of elective sessions uploaded in the LMS for the learners who could not participate in the elective sessions. This chart dominantly shows that the learners finishing the course

proactively viewed recordings, unlike the learners who did not finish. The total number of learners viewing the recordings fluctuates between three and ten.

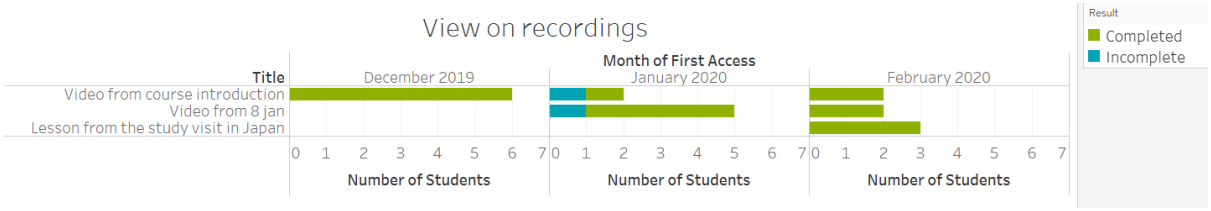

Figure 2: View on recordings

Figure 3 reveals that the majority of learners who viewed most of the learning materials completed the course, while only a small percentage of learners who did not finish the course viewed some of the materials. Additionally, the learning materials that involve course knowledge, such as “problem", “Literature seminar", “Experience from visit to Japan", and “Coaching leadership Sensei canvas" had only one to two, or no non-completing learners viewing. The materials relating to the use of LMS such as “Create a meeting in Zoom", “Manual booking", and “Create a new page" were viewed by only one or two learners, which is a low rate compared to the number of learners in total. The maximum number of learners viewing learning materials was twelve and the smallest number of learners viewing was one.

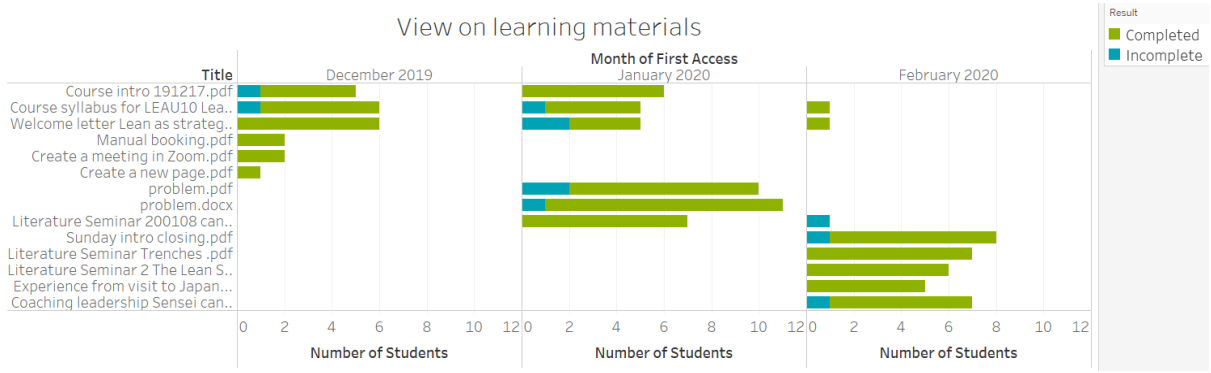

Figure 3: View on learning materials

Figure 4 shows the time that learners engaged in the discussion threads. All of these discussion threads were not mandatory, thereby revealing the self-motivation of the learners. The number of non-completing learners engaging in the discussion threads fluctuated between one and four learners. There are ten to sixteen learners in total in both groups participating in the threads. Figure 5 with assignment submissions and examinations demonstrates that the learners who completed the course engaged in assignments and examinations more than the learners who did not.

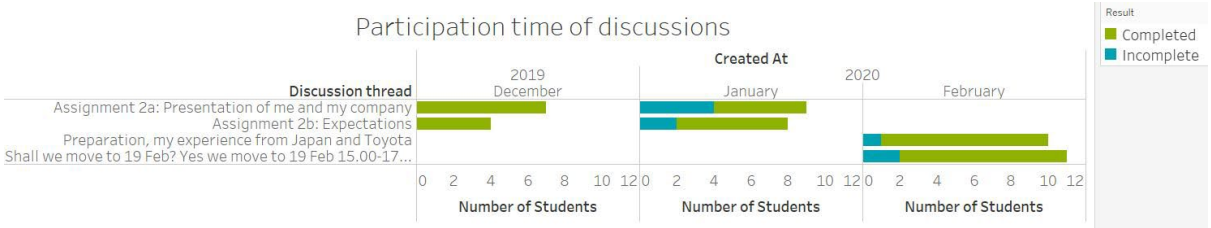

Figure 4: Participation time of discussions

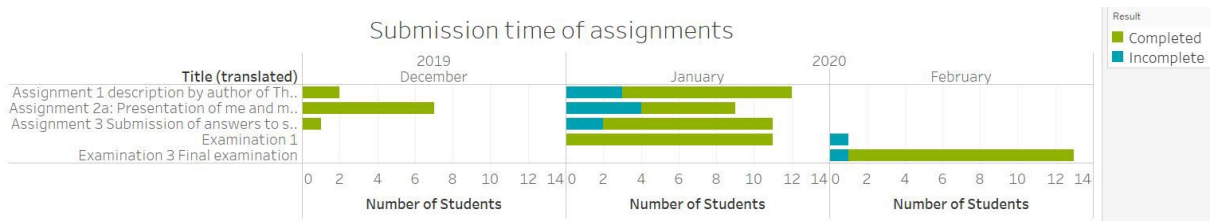

Figure 5: Submission time of assignments

The statistical data for view on instruction files, learning materials, participation in discussion, and assignment submissions are alike and presented in Table 2. The p-value (2-sided) of this dataset is 0.036 which is significant (< 0.05). Simultaneously, the p-value of the statistical data for view on recordings (Table 3) is 0.045 which is also significant (< 0.05).

Table 2: Statistical data for the engagement in instruction files, learning materials, discussion, and assignments

	Completed	Incomplete	Total
Engage	12	4	16
Not engage	0	3	3
Total	12	7	19

Table 3: Statistical data for view on recordings

	Completed	Incomplete	Total
Engage	10	2	12
Not engage	2	5	7
Total	12	7	19

In summary, premised on the visualization, Figures 1 to 5 denote that both completing and non-completing learners all engaged in the educational activities. The number of completing learners outweighed the number of non-completing learners. From the data visualization and the statistical tests, the correlation between engagement and course completion is proved in EALs' learning.

4.4 Pitfalls in the online learning design

Based on the analysis and interpretation of learning patterns, there are pitfalls identified in the current learning design of the course.

First, the number of students really engaging in learning is average to small. The educator expected that the learning materials should be viewed by the learners. However, Figure 3 discloses that there were approximately eight students of the total of nineteen who viewed the materials for seminars. The course introduction, syllabus, and welcome letter were viewed by eleven to twelve students of nineteen students in total. The observation shows that twelve students on average who participated in discussion threads are more than those viewing learning materials: seven students on average. Because the purpose of the discussion threads is to collect information rather than create a learning community, the assessment of learning can objectively be based on the view on learning materials. This is to say that the number of learners viewing learning materials is smaller than the learners answering in discussion threads, even much smaller than the total number of learners in the course.

Next, we come to the collective insight of Figure 1, 2, 3, 4, and 5 to elicit the moderate to low engagement of the learners in the course. The learners with identifiers as 1**84 and 3**59a viewed only the first instruction file named "Description of seminar and study questions" and there were three non-completing learners who did not view any instruction files (Figure 1). This demonstrates that in general the learners who did not complete the course did not participate in or only looked through the course. Additionally, the number of learners who completed and did not complete the course engaging in the educational activities is lower than the total number of learners in the course through the figures. This analysis and interpretation show that the level of engagement in the course needs to be considered.

4.5 Indicators for the online learning design improvement for employed adult learners

4.5.1 Investing in learning materials

Investing in learning materials aims to maximize their advantages integrated and designed in the course page. Due to the cases viewing only the first or no learning materials at all, how to make learning materials more compelling to learners becomes a critical concern for educators. Ally et al. (2006) disclosed that participants freely engage in any learning object involving in their work. The authors accentuated having clearly identified learning objectives for the specific learning materials and representing them in the title.

Accordingly, this indicator can be considered from two perspectives: the content of learning materials and the titles of learning materials. Illeris (2003) and Kim et al. (2021) elicited that learners likely become self-directed

in their learning if they feel connected to or engaged with the content, which reaffirms previous studies that self-directed learning has the relation with learners' perceptions of the value they put on the course. Hence, the investment on course content increase the attractiveness of the course to EALs. Regarding the titles of learning materials, Ally et al. (2006) did the study on how learners choose learning materials. The study explored the disposition of learners on choosing and utilizing the learning materials with relevant content. Thus, Ally et al. (2006) suggested that learning materials need to be titled appropriately as well as that the titles of learning materials need to reflect the content of the learning materials and be inviting.

4.5.2 Considering the increase of online interaction

Many studies underscore interaction to increase the engagement of EALs. Figure 4 shows four discussion threads, yet these threads were initiated by the educator to collect information through straightforward questions and topics, for example, introduction of learners and their companies, description of learners' learning expectations, or consultancy of changing time. The learners were supposed to answer voluntarily. The point here is a lack of stimulation and influence on constructing knowledge amongst learners through discussions, and sharing as a learning community (Holland, 2019). Although interaction was planned for the lectures and seminars as the educator elicited, there were not many meetings between the educator and the learners throughout the course. Accordingly, the interaction of learners, educators, and course content might be lessened. Meanwhile, interaction is an essential component of the learning process in both an online and offline learning environment (Cheng and Jiang, 2015). Interaction is embodied under various forms of communication, participation, feedback, reflective activity, discussion forums, or collaboration. Moreover, it is pivotal to provide the opportunities of knowledge construction through conversations (Bradley, 2021) and in the development of learning communities (Holland, 2019). To urge the development of discussions, learners should be encouraged to engage in the content and learning communities in an immanent manner with the breadth and depth as they wish (Holland, 2019). In addition, a solution to augment the connection between peers, peers-educators, and peers-content is asynchronous interaction. Asynchronous activities tally with learners who are in conjunction with other commitments and drive learners into being autonomous and self-regulating, such as exploring learning materials, engaging in effective communication, and managing their study in tandem (Bradley, 2021).

5. Discussion

As Frey and Alman (2003) showed, interaction which was not addressed in adult learning theories needs to be leveraged in online classrooms. In fact, having only a few meetings between educators and learners in online learning is insufficient to share or delve into knowledge. Moreover, due to the short time of the course and the busy lives of EALs with a myriad of commitments, it is fairly challenging for the educator to make the most time-saving schedule and still be able to engage learners throughout the course. To escalate the connection in online learning, synchronous or asynchronous interactions through discussion forums, dialogue, collaboration, and group work in LMS play a connecting role between learners, educators, and course content, and optimize the availability of learning for EALs in both time and space. High-quality interaction, full participation, and reflection do not simply happen by technology but require thorough online learning design to diminish the old fashion in traditional classrooms and take advantage of the potential of technology (Salmon, 2013). Thus, ways of working with colleagues and learners need to be rethought to produce success in online learning. Moreover, the support of educators is vital to contribute to learners' successful learning experiences (Rennie and Morrison, 2013). The support needs to be provided in a structured development process such as the five-stage model of teaching and learning online (Salmon, 2013). The support of educators can be, for instance, leaving comments on discussions, interacting with student groups in forums, posting feedback as replies to student input, and giving assessment feedback (Walji et al., 2016). The harmonic cooperation between educators and learners generates productive online interaction. Interacting with educators and peers opens opportunities for EALs to use their prior experience and receive input from the others in tandem. With varied prior experience, EALs construct knowledge in their unique ways. Online interaction increases not only individual learning but also learning communities. This helps reconcile this tension between the focus on individual learning and the desire for an active learning community (Cornelius et al., 2011).

6. Conclusion

This paper strives to propose the indicators for the online learning design improvement for EALs through the case study approach. Through the lens of learning analytics and the perspectives of the educator on the learning design for EALs, investing in learning materials and considering an increase in online interactions are the indicators to assist the growth of learners' engagement in the course, thereby improving course completion.

More than that, learning experiences are improved and technology potential is thoroughly exploited. The indicators are viewed as the first step in the process of proposing an appropriate and effective online learning design for EALs. Educators and course designers who work with EALs can consider applying the indicators to the courses which will be held in upcoming semesters or similar courses.

References

Ally, M., Cleveland-Innes, M., Boskic, N. & Larwill, S. (2006) "Learners' use of learning objects", *International Journal of E-Learning & Distance Education/Revue internationale du e-learning et la formation à distance,* Vol 21, No. 2, pp 44-57.

Anguera, M. T., Blanco-Villasenor, A., Losada, J. L., Sánchez-Algarra, P. & Onwuegbuzie, A. J. (2018) "Revisiting the difference between mixed methods and multimethods: Is it all in the name?", *Quality & Quantity,* Vol 52, No. 6, pp 2757-2770.

Bergman, M. J. (2012) *An examination of factors that impact persistence among adult students in a degree completion program at a four-year university*. Electronic Theses and Dissertations: ThinkIR: The University of Louisville's Institutional Repository.

Billett, S. (2009) "Conceptualizing Learning Experiences: Contributions and Mediations of the Social, Personal, and Brute", *Mind, Culture, and Activity,* Vol 16, No. 1, pp 32-47.

Billett, S. (2011) "Promoting lifelong employability for workforce aged over 45: Singaporean workers' perspectives", *International Journal of Continuing Education and Lifelong Learning,* Vol 3, No. 2, pp 57-73.

Bradley, V. M. (2021) "Learning Management System (LMS) use with online instruction", *International Journal of Technology in Education (IJTE),* Vol 4, No. 1, pp 68-92.

Cercone, K. (2008) "Characteristics of adult learners with implications for online learning design", *AACE Review (formerly AACE Journal),* Vol 16, No. 2, pp 137-159.

Cheng, Y. & Jiang, H. (2015) "Instant messenger-based online discourse platform and its impacts on students' academic performances: An exploratory study in art and design education", *Computers & Education,* Vol 88, pp 315-326.

Cornelius, S., Gordon, C. & Ackland, A. (2011) "Towards flexible learning for adult learners in professional contexts: an activity-focused course design", *Interactive Learning Environments,* Vol 19, No. 4, pp 381-393.

Frey, B. A. & Alman, S. W. (2003) "Applying adult learning theory to the online classroom", *New Horizons in Adult Education and Human Resource Development,* Vol 17, No. 1, pp 4-12.

Glover, I., Hepplestone, S., Parkin, H. J., Rodger, H. & Irwin, B. (2016) "Pedagogy first: Realising technology enhanced learning by focusing on teaching practice", *British Journal of Educational Technology,* Vol 47, No. 5, pp 993-1002.

Holland, A. A. (2019) "Effective principles of informal online learning design: A theory-building metasynthesis of qualitative research", *Computers & Education,* Vol 128, pp 214-226.

Illeris, K. (2003) "Workplace learning and learning theory", *Journal of workplace learning*.

Kim, D., Jung, E., Yoon, M., Chang, Y., Park, S., Kim, D. & Demir, F. (2021) "Exploring the structural relationships between course design factors, learner commitment, self-directed learning, and intentions for further learning in a self-paced MOOC", *Computers & Education,* Vol 166, pp 104171.

Kim, H.-Y. (2016) "Statistical notes for clinical researchers: Sample size calculation 2. Comparison of two independent proportions", *Restorative Dentistry & Endodontics,* Vol 41, No. 2, pp 154-156.

Leeds, E., Campbell, S., Baker, H., Ali, R., Brawley, D. & Crisp, J. (2013) "The impact of student retention strategies: An empirical study", *International Journal of Management in Education,* Vol 7, No. 1-2, pp 22-43.

Little, B. & Brennan, J. (1996) "A review of work based learning in higher education".

Rennie, F. & Morrison, T. (2013) *E-learning and social networking handbook: Resources for higher education*, Routledge.

Salmon, G. (2013) *E-tivities: The key to active online learning*, Routledge.

Short, H. & Greener, S. (2014) "Editorial: TEL in the workplace", *British Journal of Educational Technology,* Vol 45, No. 6, pp 983-989.

Smith, R., Dymock, D. & Billett, S. (2013) "Learning and training for sustained employability across working lives", *International Journal of Continuing Education and Lifelong Learning,* Vol 5, No. 2, pp 85-102.

Walji, S., Deacon, A., Small, J. & Czerniewicz, L. (2016) "Learning through engagement: MOOCs as an emergent form of provision", *Distance Education,* Vol 37, No. 2, pp 208-223.

Exploring Hybrid Course Design in Promoting Active Engagement in Extended Curriculum and Mainstream Contexts

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Abstract: The current COVID 19 pandemic has propelled evidently all courses in Universities to be taught using online technologies within a hybrid mode. There has been a cry from the academic environment on how to make student responsive and engaged in a very lonely online environment as opposed to face-to-face classrooms that are seen as engaging and responsive. This study seeks to investigate in both extended curriculum programme and mainstream programmes how hybrid courses are designed such that they can promote active engagements. This is of interest in these programmes because of the approach to curriculum design in extended curriculum programmes versus mainstream programmes. The research design is that of an interpretative paradigm within case study design using a qualitative research approach. The sample for the study is made up of three faculties extended curriculum programmes and mainstream courses in a traditional University in South Africa. The main reason behind selecting three faculties with extended curriculum and mainstream is to understand the difference in how engagements are designed in the hybrid models in extended curriculum versus mainstream. This is to further enhance hybrid engagement between these two programmes. In each of these three faculties, two courses were selected because of their engagement in online learning and hybrid learning initiatives, making a total number of six courses. Activity Theory was used to analyse the hybrid/blended learning environments and focus group interviews were analysed to identify conditions, which enable and constrain engagement in these hybrid environments. The study concludes that it is imperative that academic development supports and enhances the development and agency of academics in creating active and engaging hybrid or online environments in both extended curriculum and mainstream programmes.

Keywords. hybrid/blended learning, course design, active engagement, extended curriculum, foundation

1. Introduction

The current COVID 19 pandemic has propelled and made it mandatory for evidently all courses in Universities to be taught using online technologies. This has made it mandatory for many Universities to move to hybrid models of teaching and learning. This has put a high demand for online courses that provide student engagement. There has been a cry from the academic environment on how to make student responsive and engaged in a very lonely online environment as opposed to face-to-face classrooms that are seen as engaging and responsive. Some of the challenges revolved around technical and personal issues associated with online teaching and learning during COVID-19 like digital literacy skills, teaching with technology and integrating it with pedagogy, resource constraints, and e-course design etc. COVID -19 literature on the impact of the pandemic on teaching and learning cites non-participation of students and lack of engagement in online/ blended classes (Diningrat, 2020; Kulal and Nayak, 2020; and Noor et al 2020). Challenges revealed by most of the above studies ranged from "that limited bandwidth, connectivity, and security were the first significant barriers perceived by early childhood lecturers. Meanwhile, additional barriers are related to student lack of engagement and lack of feedback (Diningrat, 2020)", then Kulal and Nayak 2020 also found that "teachers are facing difficulties in conducting online classes due to a lack of proper training and development for doing online classes. Technical issues are the major problem for the effectiveness of the online classes". Other studies highlighted that "the issues and challenges confronted by school teachers in delivering online lessons via Google Classroom, Zoom, and Microsoft Teams such as high-cost Internet packages, uncooperative learners, low attendance of learners, teachers' technology confidence, limited availability of educational resources, lack of ICT knowledge, and poor network infrastructure (Noor et al. 2020)". Whilst Johnson, Veletsianos, and Seaman, 2020 found that the "primary areas where faculty and administrators identified a need for assistance related to student support, greater access to online digital materials, and guidance for working from home".

This study seeks to investigate how academics design their online courses such that they can promote active student engagements in their online classrooms. Benefits of online student engagement include student satisfaction, motivation to learn, reduces sense of isolation, and improved student performance in online courses. It is also argued that it increases student attention and focus and motivates them to engage in higher-level critical thinking (https://olj learning consortium.org). The cpet.tc. Columbia.edu speaks to three pillars of

student engagement: academic, intellectual and social-emotional- organically-supported in F2F learning, BUT, they must be explicitly pursued in remote /blended learning (cpet.tc.Columbia.edu)

Blended Learning spaces that use technology are a common phenomenon in Higher Education. The University where the present study was undertaken embarked on an Online and Hybrid Teaching and Learning project in the past two years. A number of studies have been done that look at Lecturers' experiences on the use of technology within these Blended/Hybrid Learning spaces. Most of the studies that look at the phenomenon of engaging students in online environments are at primary and high school levels, very few studies have looked at the experiences of engaging students in an online environment in the Higher Education sector and, whether who supports and assists the Lecturers in the implementation of Blended Learning.

2. Background of the study

The study takes place at a traditional university in South Africa. Traditional Universities are distinguished from the other two categories of Universities through their offerings of more theory-aligned qualifications. The University under study is based in a semi urban environment in the Eastern Cape Province of South Africa. The majority of the Eastern Cape landscape is rural; hence, most of the University's student body comes from these humble beginnings.

The majority of the University's mainstream students come from disadvantaged background, and computer facilities were not available in their schooling background in the majority of the schools. Mainstream students are student who qualify to get into University because they have passed their matric with a Degree entry. The second cohort of students admitted to our University are admitted into extended curriculum programmes (ECP). Extended Curriculum programmes are but one opportunity for the students from these communities and more other semi-urban environments are allowed access to the University. The primary purpose of Extended Curriculum programmes is to improve the academic performance of students who are at risk due to their educational backgrounds. Foundation Provisioning was/is one of the strategies introduced to improve throughput and success rates in Higher Education Institutions (HEI). This means that the students who enrol for these programmes will do their studies over four years instead of three years, allowing them more time to do their foundation courses in the 1st two years. Fully Foundational course.

Figure 1: Representation of a three year extended curriculum

Extended curriculum courses combine regular course material with substantial foundational material and are substantially longer in duration than a pure regular course. This includes offering of modules, courses or other curricular elements that are intended to equip underprepared students with academic foundations that will enable them to successfully complete a higher education qualification. Focuses particularly on basic concepts, content and learning approaches that foster advanced learning. Both categories, mainstream and extended curriculum first entry students come to University with a certain level of articulation gap. For example, the articulation gap ranges from; content and conceptual development, approaches to learning, academic language (Discourses) and affective factors (Scott et al, 2007). These are but some of the challenges the academic environment is faced with, adding to these is the level of digital skills and engagement with digital technologies that both students and staff struggle with.

In the University understudy online learning, sometimes referred to as e-Learning, and is used in a Blended Learning context. Online courses are delivered over the internet using a Learning Management System. The LMS used in this case study for the purpose of Blended Learning is called 'Blackboard' (BB). Blackboard provides an online space where there are varieties of tools, which can be used to enhance the teaching and learning environment. The rationale behind using Blackboard was that there was provision of training and technical support by the academic development team.

3. Literature review

The literature and theories on student engagement speak to the various types of course activities that the lecturer designs to promote content understanding and student engagement. The activities, which should be embedded in course design. They may be synchronous, asynchronous or a combination of the two. The literature also focuses on learner interactions, how students within digital courses through various online technologies such as discussion boards, blogs, wikis, journals, video-conferencing facilities, file sharing and reading materials engage with the course (Digital Teaching Learning Series). It is important that (digital) course design include all, if not most of these activities. In addition, it should be pedagogy, not digital tools that inform the choice of e-tools that should be used to promote student engagement.

There is vast literature in the past two years on different ways of engaging students in online environments but it mainly focuses on mainstream students, which means students who have been admitted through the normal university system. Prince, Felder & Brent 2020 speak to synchronous and asynchronous engagement strategies that establish and maintain physical and social presence early in the course then throughout the course. They further emphasize the importance of making sure that policies are explicit and clear about expectations, assignments and how extensively formative assessment will be carried out. This will eliminate resistance to active engagement and information being communicated early. At the same time, they suggest a gradual approach to engagement strategies (Prince, Felder & Brent 2020). Tomas, Lase, Field & Skamp, 2015 argue that direct instruction offers little support for engagement with the learning material or between peers (Tomas, Lase, Field & Skamp, 2015).

Green et al. also suggest some strategies for maximizing online student engagement and these include student-centered strategies, self-directed engagement with the learning material, which is supported through explicit scaffolding (Green et al. 2020). Appropriate use of media/ICTs and authentic/challenging assessment tasks embedded in the online modules and tutorials promote engagement (Tomas et al., 2015). Ngambi, Baguma, Nalubowa, 2020 suggest embedding You Tube videos on presentations as a way of creating interactive engaging presentations. Dixson et al, 2015 argue the importance of teachers' "*ability to integrate multifaceted learning goals into instructional planning and delivery* in order to create effective online learning environments that may improve outcomes for students across settings and content areas" (Dixson, 2015 in McKeithan, G, Rivera, M. & Mann, L, Mann, and L 2021). The types of online student interactions alluded to are between student-content; student- student; student-teacher- interactions; synchronous and asynchronous (Dixson, 2015 in McKeithan, G, Rivera, M. & Mann, L, Mann, L 2021).

Johnson et al. 2018; Dykman & Davis (2008); Renes & Strange, (2011) found that it is imperative that instructors also master the relevant software and hardware needed to teach in their online classrooms, if they want to encourage engagement. This is mostly to be noted in the COVID 19 academic environment, that most lecturers were forced to go online by the pandemic and the level of experience with digital tools was basic, let alone having to redesign courses. Leslie (2021) argues that a redesigned course is more effective and important for encouraging engagement.

Feedback is an important aspect of student engagement and can either stifle interaction in a course or lead to robust discussions amongst the students themselves and between the students and the lecturer. Giving feedback online can be achieved in several ways. Mamoon-Al-Bashir, Rezaul Kabir, Ismat Rahman (2016), list the following e-feedback strategies: e-mail for group and individual feedback, audio and video feedback (M3 players and podcasts), screencasts, and recycling written comments.

4. Research design and methodology

A research design is a plan that guides the researcher in the process of collecting, analysing and interpreting data. The research design is that of an interpretative paradigm within case study design using a qualitative research approach. Paradigms are defined as ways to understand phenomena (Bryman, 2001) and are differentiated by their ontological, epistemological and methodological assumptions. Further to this Babbie (2007) highlights the interpretive approach as committed to studying meaning in context. Such research explores "... socially meaningful interactions through looking at experiences in this case engagements in context, in order to arrive at understandings and interpretations of how the engagements are created and maintained within these virtual communities" (Neuman, 1997). This research is a case study aimed at understanding a contemporary phenomenon in a real life context (Yin, 2003). This case study employs

qualitative research methods. Qualitative case study methodology provides tools for researchers to study complex phenomena within their contexts (Baxter & Jack, 2008) and afford researchers opportunities to explore or describe a phenomenon in context using a variety of data sources. Yin, (2003) argues that one of the reasons one would use case study research is when "you want to cover contextual conditions because you believe they are relevant to the phenomenon under study" which is one of the reasons this study uses case study research.

The population for the study is made up of a sample of three faculties mainstream and extended curriculum programmes (Faculty of Management and Commerce, Social Science and Humanities, and Science & Agriculture) in a traditional University in South Africa. Selection was based on willingness, availability and a spread across each of the three faculties. The selection could be said to be purposive in nature, as it required that there be at least a representation in each faculty of both mainstream and extended curriculum programmes. While this was the intention, this did not quite work out in the end, as there was one faculty that was not represented because it did not offer an extended curriculum programme. The main reason behind selecting three faculties with both mainstream and extended curriculum is to understand the difference in these contexts disciplinary engagements within hybrid models and to further enhance student engagement in both programmes. In each of these three faculties, two courses were selected because of their engagement in online learning and hybrid learning initiatives, making a total number of six courses. Secondary data sources are used in the form of course outlines or learning guides and online course designs.

Analysis of data involves iinterpretations of data in the form of texts, unpacked using thematic analysis to identify key concepts/genre, context, artefacts (pictures and materials) and capture relevant tensions aligned with the research question. Ryan and Bernard (2000) describe coding as the heart and soul of whole text analysis. According to Silver et al., 2010 "many qualitative analyses involve organising data by way of conceptually or thematically coding them, and coding is the main aspect of managing the interpretations. These themes are further analysed using the Activity theory framework to gather were the tensions and contradictions are placed. The analysis offered a deeper insight into the institutional context and the expectations of the institution about online environments.

5. Theoretical framework

Cultural Historical Activity Theory (AT) is used in the study as a theoretical framework for this research. This theory forms the basis for the main analysis of exploring the course design and how it promotes active engagement in the online courses. The term Cultural Historical Activity Theory was invented by a Russian psychologist known as Lev Semenovich Vygotskii, in 1978. His works were later developed further by two of his students Leont'ev and Engeström. This study will use Leont'ev's Activity Theory perspective, which is called the Second generation Activity Theory.

Activity Theory theorizes that when individuals engage and interact with their environment, production of tools results (Roth & Lee, 2007). Activity Theory offers a lens through which researchers can analyse human activity systems. It focuses on the interaction of human activity and consciousness within its relevant environmental context (Jonassen, Peck, & Wilson 1999). The second generation activity theory was developed by Leont'ev, one of Vygoskii students. He broadened the Activity theory concept and triangle by adding the concepts of rules, division of labour and community. The Leont'ev perspective was that all three components of the Activity system are inseparable; these components should be studied in relation to each other and their context.

Our three units of analysis: the interacting activity systems are idenfified as the three faculty's courses understudy. We have three activity system which are our the main unit of analysis which are made up of tools, which can be anything from a computer, to software (LMS), a mobile phone and clicker, used by the subject (which is the individual or student) to achieve an objective (object/outcome) which is what the Lecturer intended to achieve with the student engagement activities. Using the Activity theory Framework above, the study will analyse each of the faculty course designs for mainstream and extended curriculum, comparing what tools where used as mediating artefacts to enable student engagements in the courses understudy.

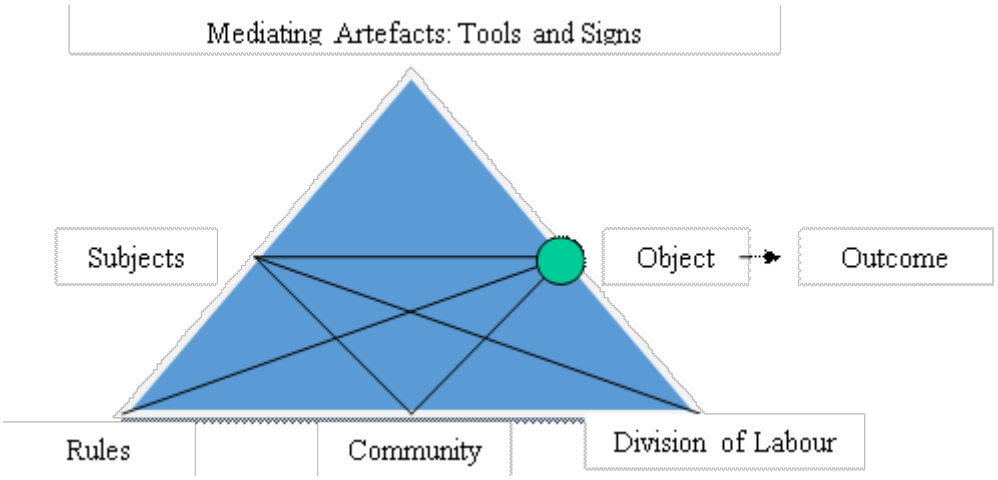


Figure 2: Leont'ev's perspective (second generation activity)

6. Findings

The findings for the study are representative of three faculties and six courses from faculty mainstream and extended curriculum programmes. Therefore, in each faculty, we have one mainstream course and one extended curriculum course. The results will be presented in line with the Activity theory framework dimensions, which are incorporating snap shorts/screen shorts of evidence in course design from the different courses.

6.1 Findings for faculty one

The results below display two courses from the Faculty of Social Science and Humanities.

C*ourse 6.1A-Extended Curriculum.* The first course analysed below in an English for academic purpose course. The first identifiable engagement activity in the course are tutorial exercise that should be conducted by the Tutor for the students. We are well aware that in most of the tutorial sessions there is a lot of active engagement and collaboration between students, with the assistance of the Tutor. The second identifiable engagement activity in *course 6.1A* is an assessment test, as the assessment are now conducted using the Blackboard assessment tool. Because the engagement in an assessment task is the student's response to the assessment and the lecturer feedback, this is more asynchronous and does not allow for much interaction.

The screen shots for the course below clearly showcases a possible engagement with students on the different types of tutorial activities outside of the online course. There is no clear indication of which online tool the tutor and students use to engage with the tasks. The researcher does acknowledge that the classes and tutorial sessions did take place online where most active interaction could have taken place. There is not much on the summative assessments, but this can be seen as limiting, as it is more towards Lecturer's and Students, but little evidence of student-to-student engagement. When one observes the online course design, the course content and materials for tasks/activities are seen as more of a replacement of the traditional ways of engagement, as there is no much change or redesign of the assessment activities. Through the screen shots below, it is identifiable that both the content and tutorial activities are in the format of files that have been uploaded to the LMS.

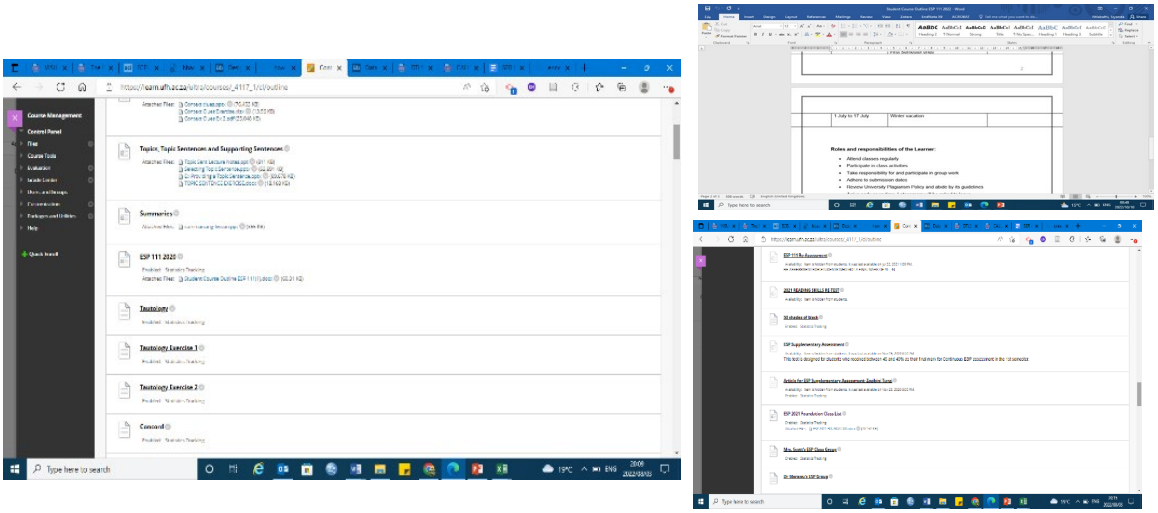
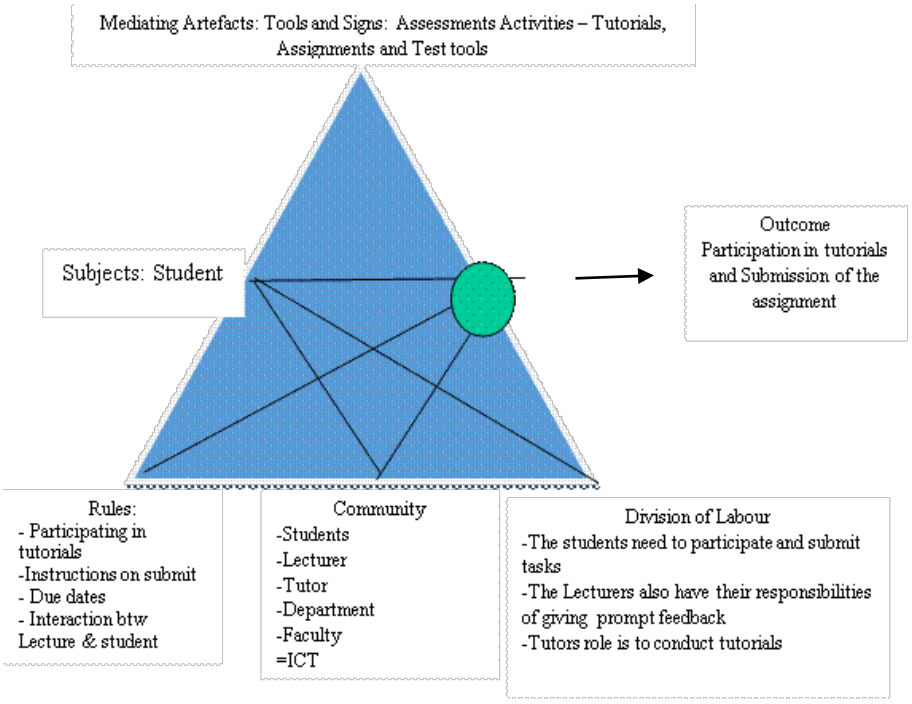


Figure 3: Course 6.1A online course and learning guide screenshots

The screen shot above showcase the tutorials and assessment activities incorporated in the course design. Below is the course 6.1A activity system, displaying the mediating artefacts, which are Tutorials and Assessments upload in the LMS, for the subjects, who are students. The object, which is the outcome, is for the students to participate in the tutorials in order to get a better understanding of the course content and to submit the assignments for feedback. Rules and division of labour are clearly spelt out in the course outline as per one of the screenshots above, but these are limited or only apply to the students. Rules and division of labour should be clearly spelt out for both the student and the Lecturer so that there are no tensions and contradictions. This will enable both students and lecturers to be aware of their roles and responsibilities. Both student and lecturers community encompasses the department staff, faculty staff and ICT department for matters to do with computer technical and network issues.



To achieve active engagement the online course must not just contain assessment and tasks that students can engage in outside of the LMS tools. There should be online activities that are visible within the online course design, like online discussion forums and collaborative activities that students in groups can participate in. In the above course none of such activities are visible in the online course. It is clear that in this course there was no redesign of the online course as advocated for by Leslie 2021, who argues that a redesigned course is more effective and important for encouraging engagement. This means for the Lecturer to achieve the outcome of

evident participation an active engagement of students in the online course, the design should integrate these tutorial activities within the online course.

Course 6.1B- Mainstream is the second course analysed in the Faculty of Social Science and Humanities. This course in mainstream is also an English course also offered to first year students in this faculty and other faculties. When identifying the key engagement activities in this course, the notable engagement with students is through group discussion forums that are posted on the LMS, but the discussion themselves take place through WhatsApp. There is also engagement through tutorial groups and assessment activities like assignments and tests.

The screenshots below show how the course design is and some of the visible activities that students have to do, as outlined in the course-learning guide. As much as there is not much consideration for online course design principles, but there is much allowance given to engaging activities for the students. Considering that, this is the only course with a discussion forum, which extends to WhatsApp, is a good enhancement for the course and for the students.

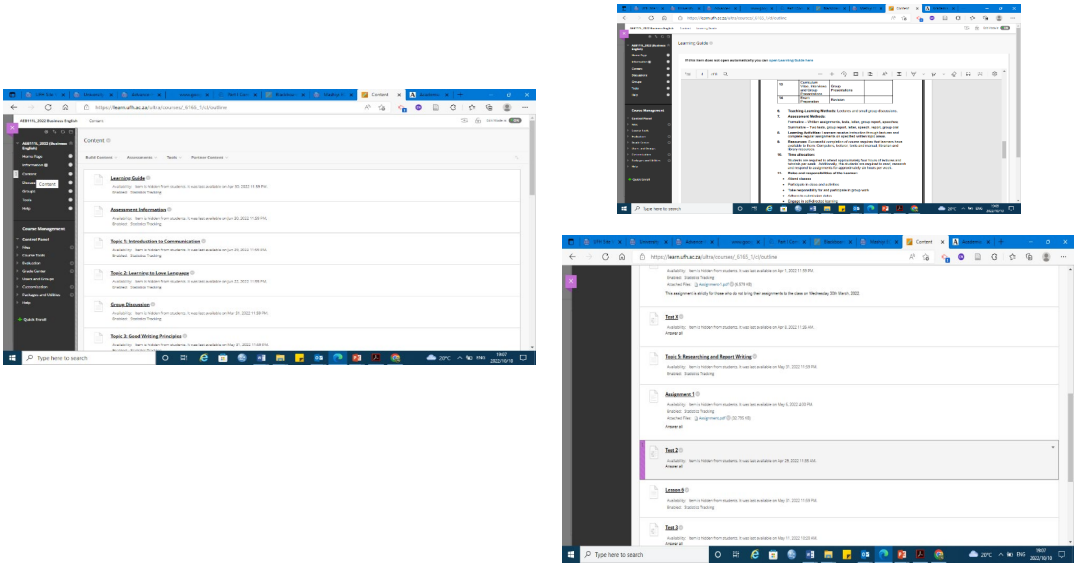
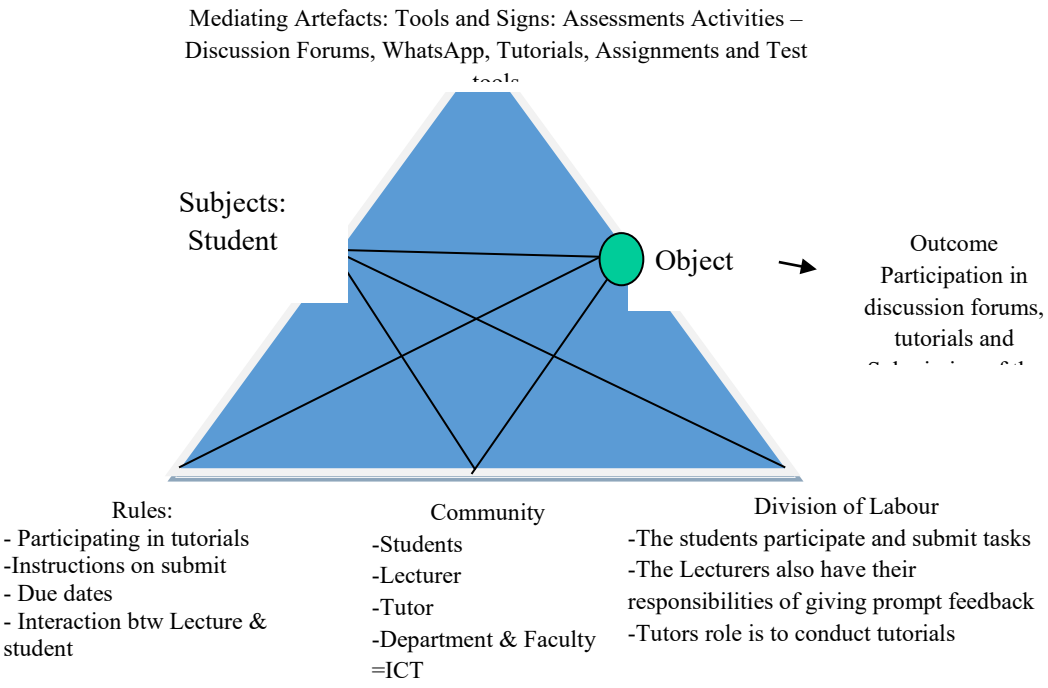


Figure 4: Course 6.1B online course and learning guide screenshots

Below is the course 6.1B activity system, displaying the identified mediating artefacts, which are tutorial group and discussion forums, WhatsApp, assignments, and tests available in the LMS, for the subjects, who are students. These discussions take place asynchronous and Prince, Felder & Brent 2020 who advocate that synchronous and asynchronous engagement strategies that establish and maintain physical and social presence early in the course are preferred and should continue throughout the course, argues this mode of discussion. The object, which is the outcome, is for the students to participate in the small group discussions, tutorials in order to get a better understanding of the course content and to submit the assignments and tests for feedback. Rules and division of labour are clearly spelt out in the learning as per one of the screenshots above of the learning guide, and these are there for both the lecture and students. Rules and division of labour should be clearly spelt out for both the student and the Lecturer so that there are no tensions and contradictions. This will enable both students and lecturers to be aware of their roles and responsibilities. Both student and lecturers community encompasses the department staff, faculty staff and ICT department for matters to do with computer technical and network issues. In the literature review Dixson et al, 2015 argue the importance of teachers' "*ability to integrate multifaceted learning goals into instructional planning and delivery* in order to create effective online learning environments that may improve outcomes for students across settings and content areas"



6.2 Findings for faculty two

The next faculty understudy is the faculty of management and commerce as showcased below. The next two course designs results we looked at where both from the economics department. One was Economics for the first years extended curriculum and the second course is for first year students in the mainstream economics course. Below is a further outline of the results.

Course 6.2A- Extended Curriculum: This is an economics course for first year students in extended curriculum. After having studied the online course design and the learning guide, the following activities were visible and identifiable; small group tutorial sessions, group assignments and tests.

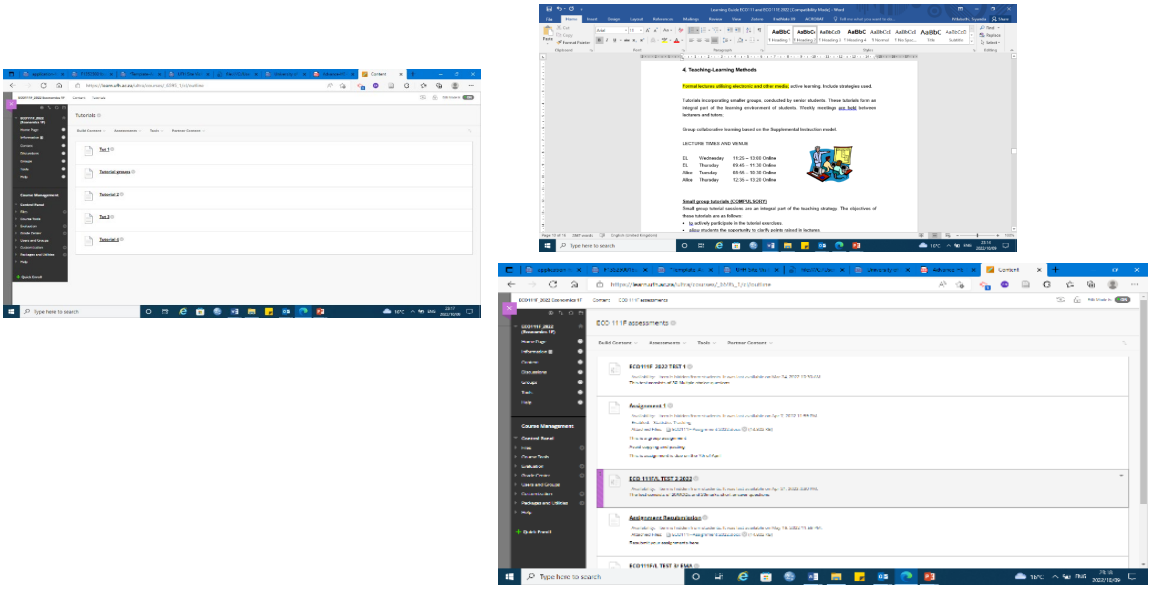
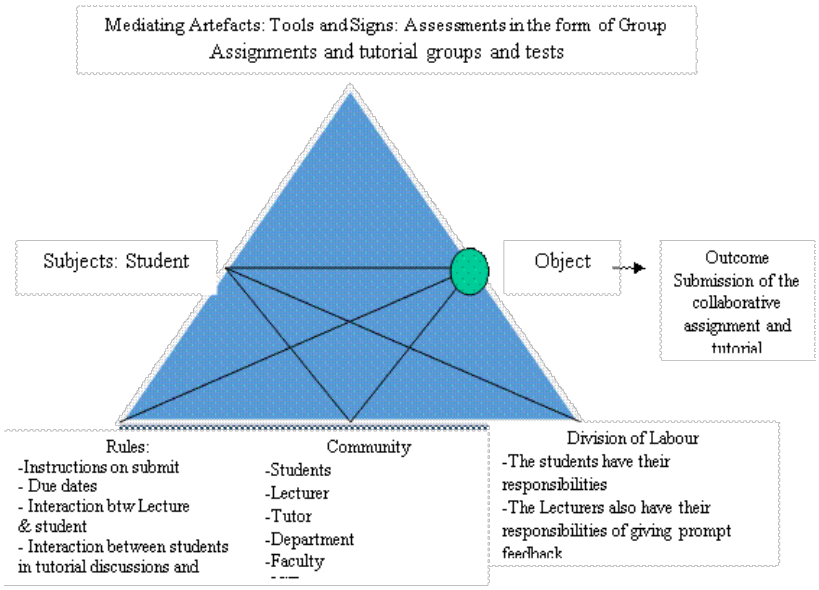


Figure 5: Course 6.2A online course and learning guide screenshots

In this activity system (course 6.2A), the mediating artefacts showcased below are inclusive of small group tutorial sessions, group assignments and tests uploaded in the LMS, for the subjects, who are students. The

object, which is the outcome, is for the students to participate and interact in the small tutorials groups in order to get a better understanding of the course content and to submit the collaborative group assignments for feedback to achieve the outcome. This allow for further active engagement between the students. Rules and division of labour are clearly spelt out in the learning guide as per one of the screenshots above, for both the lecturer and the students. This may limit any tensions and contradictions. This will enable both students and lecturers to be aware of their roles and responsibilities. Both student and lecturers community encompasses the department staff, faculty staff and ICT department for matters to do with computer technical and network issues.



Since there are clear, roles and responsibility stated in this community, the students and students, lecturer and students as well and tutor and students will be enabled to carry on well with their tasks. The lecturer course design is still at the level of replacement or substituting face to face through uploading content and activities and tests in the LMS but there in some enhancement through the collaborative assignment which is done online by the students using the collaborate tool within their course.

Course 6.2B-Mainstream: This is an economics course for first year students in mainstream. In the online course design and the learning guide, the following activities were visible and identifiable; video tutorials, small group tutorial sessions, individual assignment and tests.

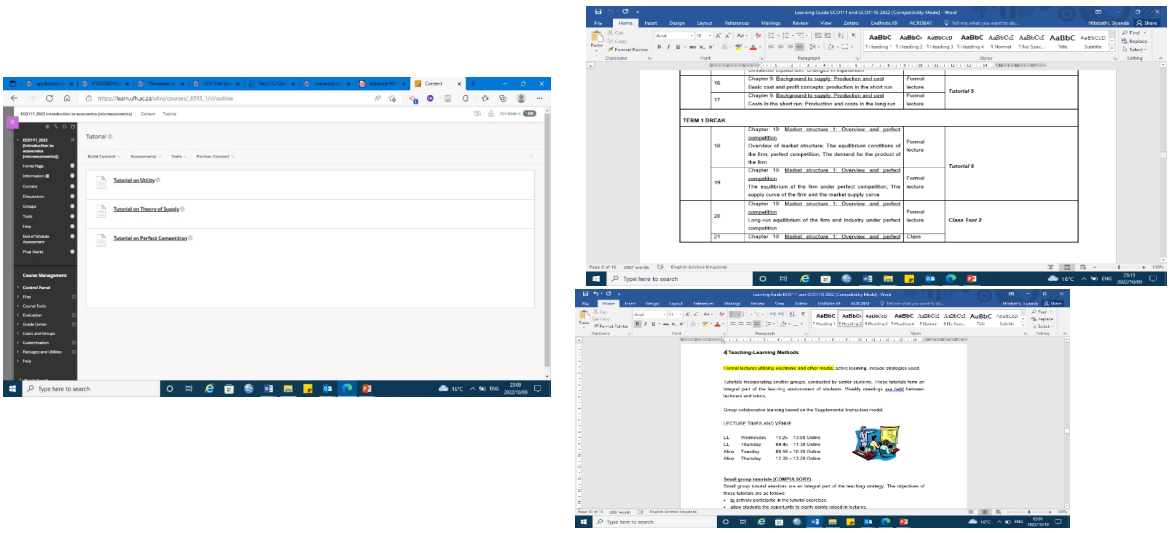
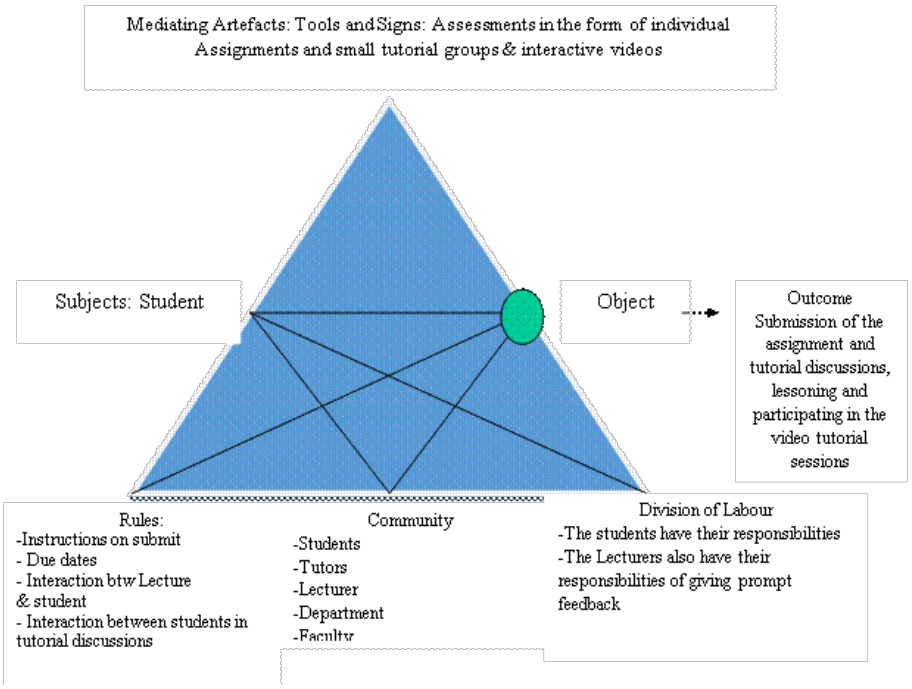


Figure 6: Course 6.2B online course and learning guide screenshots

In this activity system (course 6.2B), the mediating artefacts showcased below are inclusive of video tutorials, small group tutorial sessions, an individual assignment and tests uploaded in the LMS, for the subjects, who

are students. The object, which is the outcome, is for the students to participate and interact with the video tutorials and participate in the small tutorials groups in order to get a better understanding of the course content and to submit the individual assignment for feedback to achieve the outcome. In this course, a new item/tool was not there in other courses the video tutorials for further active engagement between the students. Ngambi, Baguma, Nalubowa, 2020 as a way of creating interactive engaging presentations, suggested embedding You Tube videos. This suggests the course design is on the right path. Rules and division of labour are clearly spelt out in the learning guide as per one of the screenshots above, for both the lecturer and the students limiting any tensions and contradictions that may arise due to misunderstanding of roles and responsibilities. Both student and lecturers community encompasses the department staff, faculty staff and ICT department for matters to do with computer technical and network issues.



6.3 Findings for faculty three

The last faculty to look at is the faculty of Science and Agriculture. In this faculty, we looked at the maths and introduction to computers course. *Course 6.3A: Extended Curriculum* is a mathematics course, the most identifiable engagement opportunities is through collaborative tutorials groups and practical tests.

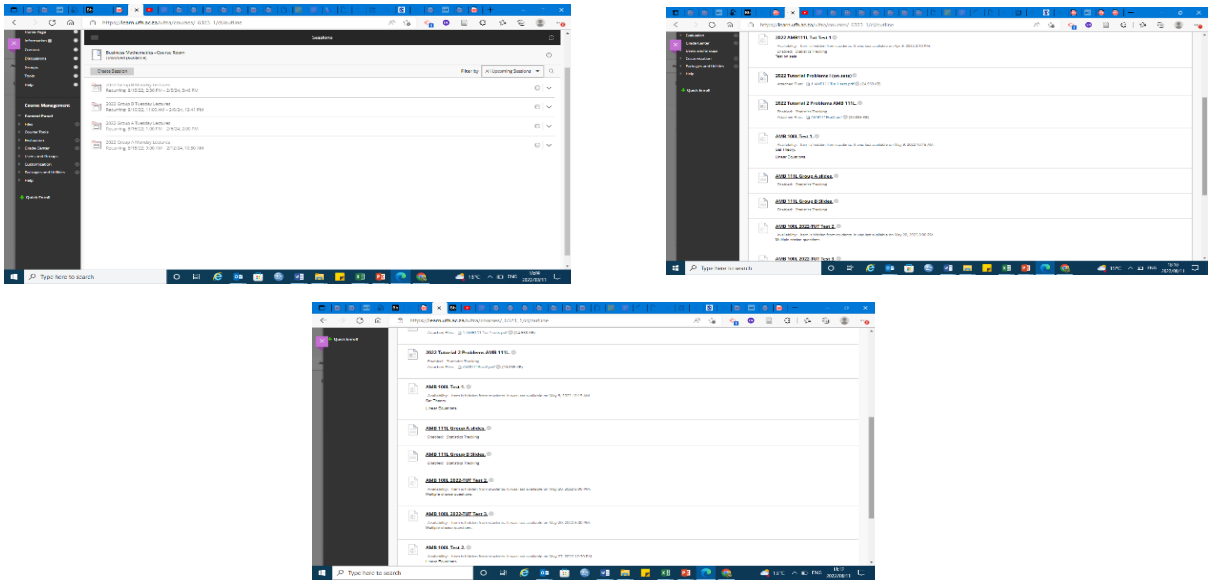
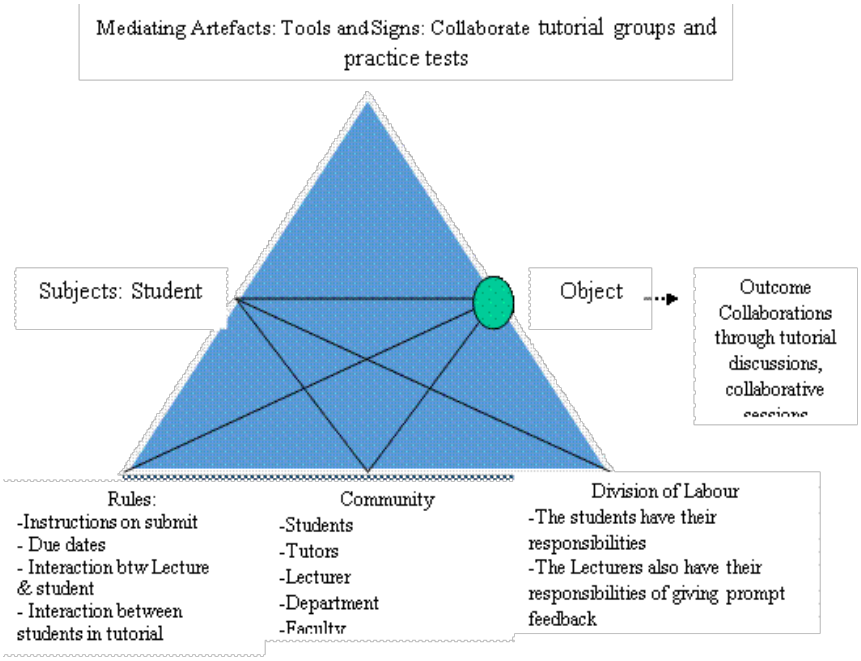


Figure 7: Course 6.3A online course and learning guide screenshots

Activity system (course 6.3A), the mediating artefacts showcased below are inclusive of collaborative tutorials and practical's, which are needed in a course like maths, an individual assignment and tests uploaded in the LMS, for the subjects, who are students. The object, which is the outcome, is for the students to participate and interact in the tutorials and submit the individual assignment and tests for feedback to achieve the outcome. Rules and division of labour are not there and the learning guide is not made available in the online course. Both student and lecturers community encompasses the department staff, faculty staff and ICT department for matters to do with computer technical and network issues.



Course 6.3B: Mainstream- This course is an introduction to computers course that is taught to first year students in the faculty. Below are screenshots representative of the online course design. These are followed by an activity theory analysis of the activities in the course that allow for active engagement.

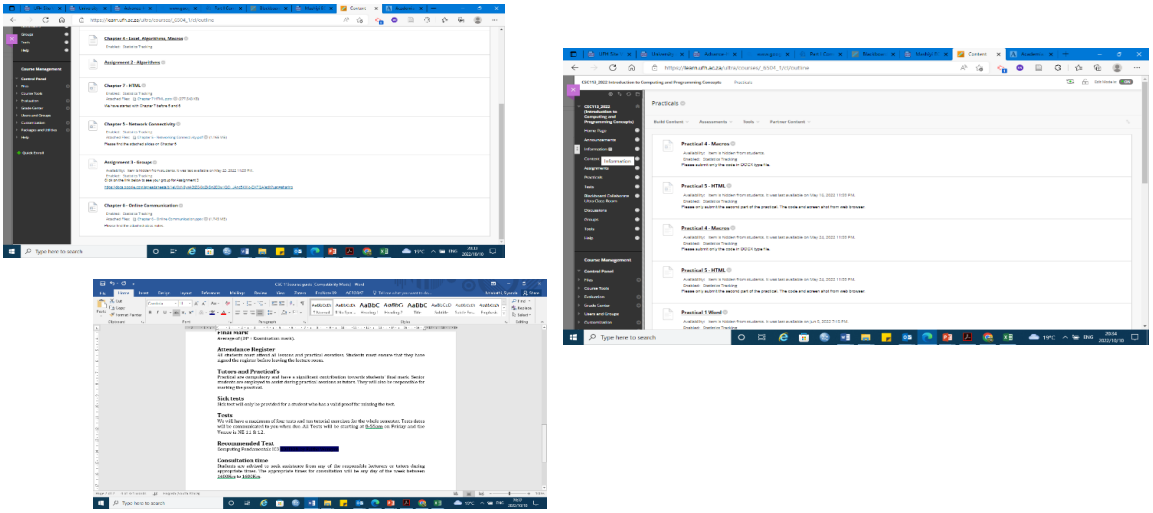
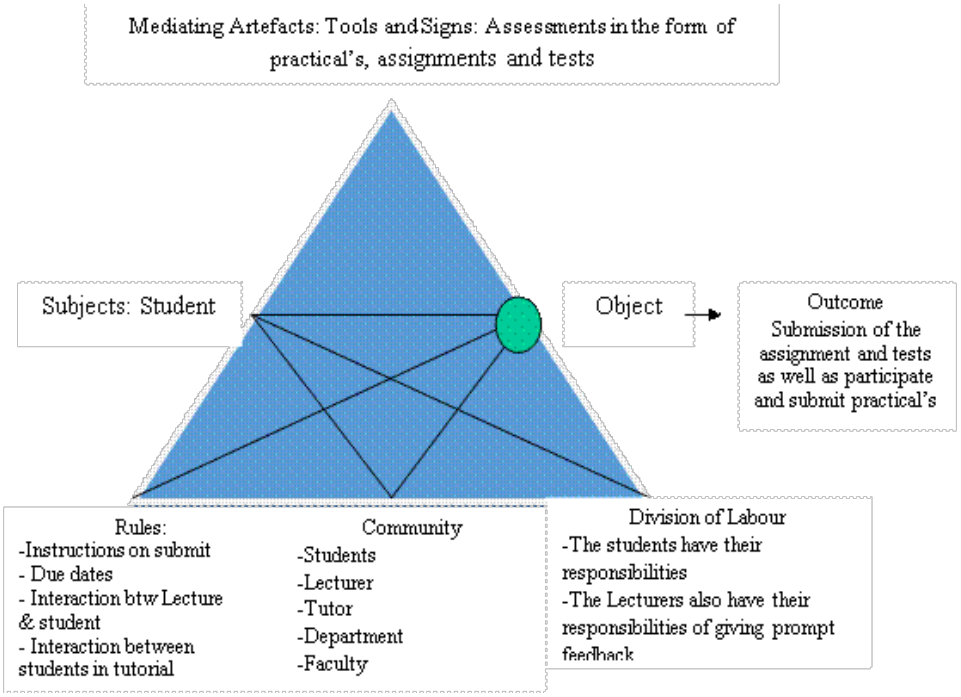


Figure 8: Course 6.3 B course and learning guide screenshots

Activity system (course 6.3B), the mediating artefacts showcased below are inclusive of collaborative practical's, which are needed in a course like computers, an individual assignment and tests uploaded in the LMS, for the subjects, who are students. The object, which is the outcome, is for the students to participate and interact in the practical's and submit the individual assignment and tests for feedback to achieve the outcome. Rules and division of labour are also not there and the learning guide is not made available in the online course. Both student and lecturers community encompasses the department staff, faculty staff and ICT department for matters to do with computer technical and network issues



All the above courses have no course design or instructional design principles applied. It is evident that in all the courses the lecturers need capacity building in designing engaging online courses. Some of the courses understudy were available prior the COVID19 pandemic, which means these are additional to the COVID 19 courses suggesting a need for more academic support to enhance the skills of lecturers in designing pedagogically sound online environments. As much as two of the six courses analysed where mainly evident that there has been some thinking and change in the course design as the course were inclusive of reading materials, content in the course which embedded some activities that the students needed to do. Other courses were more indicative of what would have been done in a face-to-face environment. Others have enhance their module by including one or two of active engagement. Another noticeable missing component in all the learning guides are the rules of engagement between the tutors and students.

Rules and division of labour are clearly stated for the students and the lecturer but are clearly not there for the tutor in the online course and in the learning guide. Of the six courses analysed, it was evident that there had not been much change in the course design. The courses included mainly reading materials and content which was indicative of what would have been done in a face-to-face environment.

7. Conclusion and recommendation

The literature and theories on student engagement speak to the importance of planning and designing a variety of teaching - learning activities that promote and enhance student learning in face-to-face, online or hybrid contexts. Designing these activities should be part and parcel of course design, not as an add-on, and should be guided by the principle of student-centeredness (Green et al. 2020). The focus should be more on what the student does than on what the lecturer does (Biggs, 2011). Only one course in the Faculty of Management and Commence prioritised student engagement activities while others enhanced their modules by including one or two of active engagement tasks. It is evident from the results of the study that a lot still needs to be done to get lecturers to create engaging activities for their students.

The study concludes that it is imperative that academic development supports and enhances the development and agency of academics in creating active and engaging hybrid or online environments. It is evident from the results of the study that is still a lot that need to be done to get Lecturers to create very engagements activities for student. Staff development programmes that promote the lecturer's online, physical, and social presence (Prince, Felder & Brent 2020) would go a long way in motivating students and enabling them to achieve the desired outcome. The limitation of the study is that it focused on three faculties in one traditional university. Further research on student engagement in a variety of contexts is needed in order to understand lecturer's training needs and provide the necessary support.

References

Babbie, E. R. (2007). The Practice of Social Research (11th ed., International student Ed.). Belmont, CA: Thomson/Wadsworth.

Biggs, J. &Tang, C. 2011. Teaching for Quality at University, SRHE and Open University Press

Bryman, A. (2001). Social Research Methods. Oxford: Oxford University Press.

Diningrat, S W M; Nindya, M A; Salwa, S, 2020. EMERGENCY ONLINE TEACHING: EARLY CHILDHOOD EDUCATION LECTURERS' PERCEPTION OF BARRIER AND PEDAGOGICAL COMPETENCY. Jurnal Cakrawala Pendidikan, [S.l.], v. 39, n. 3, p. 705-719, oct. 2020. ISSN 2442-8620. Available at: <https://journal.uny.ac.id/index.php/cp/article/view/32304>. Date accessed: 19 June 2022. doi:https://doi.org/10.21831/cp.v39i3.32304.

Dykman, C. A., & Davis, C. K. (2008). Online education forum: Part three - a quality online educational experience. Journal of Information Systems 19(3), 281-289

Jonassen, D. H., Peck, K. L., & Wilson, B. G. (1999). Learning with Technology: A Constructivist Perspective. Upper Saddle River, N.J: Merrill.

Johnson, N., Veletsianos, G., & Seaman, J. (2020). U.S. faculty and administrators' experiences and approaches in the early weeks of the COVID-19 pandemic. Online Learning, 24(2), 6-21. https://doi.org/10.24059/olj.v24i2.2285

Kulal, Nayak, 2020. A study on perception of teachers and students toward online classes in Dakshina Kannada and Udupi District, Asian Association of Open Universities Journal, volume15, p285-296

Leslie, H. J. (2021). Facilitation fundamentals:redesigning an online course using adult learning principles and trifecta of student engagement framework. Journal of Research in Innovative Teaching & Learning Vol. 14 No. 2, 271-287.

Mamoon-Al-Bashir, Rezaul Kabir, Ismat Rahman, 2016, The Value and Effectiveness of Feedback in Improving Students' Learning and Professionalizing Teaching in Higher Education, Journal of Education and Practice. Vol. 7 (16).

McKeithan, G, Rivera, M. & Mann, L,Mann, L 2021 Strategies to Promote Meaningful Student Engagement in Online Settings, Journal of Education and Training Students 9 (4) 1-11.

Neuman, W. L. (1997). Social Research Methods: Qualitative and Quantitative Approaches (3rd ed.). Boston, Mass: Allyn & Bacon.

Ngambi, D. Baguma, R. 2020. Enhancing Student Interactions in Online Learning: A case of using You Tube in Distance Learning. Higher Education Research.

Noor, Shaista; Isa, Filzah Md.; Mazhar, Faizan Farid, 2020. Online Teaching Practices during the COVID-19 Pandemic. Educational Process: International Journal, v9 n3 p169-184, ISSN: ISSN-2147-0901

Prince, M. Felder, R, Brent,R, 2020.Active Student Engagement in Online STEM Classes: Approach and Recommendations, Fall 2020, 8 (4).

Sliver, C. and Lewins, A. 2010. Computer assisted qualitative data analysis. In P.L. Peterson, E.L. Baker and B. McGaw International Encyolpedia of Education. Amsterdam: Elsevier, 326 – 334

Tomas, Lasen, Field & Skamp 2015.Promoting Online Students' Engagement and Learning in Science and Sustainability Preservice Education., Vol. 40 Issue 11.

Renes, S. L., & Strange, A. T. (2011). Using technology to enhance higher education. Innovative Higher Education DOI 10.1007/s10755-010-9167-3, 203-213

Roth, W.-M., & Lee, Y.-J. (2007). "Vygotsky's Neglected Legacy": Cultural-Historical Activity Theory. Review of Educational Research, 77(2), 186–232. doi:10.3102/0034654306298273

Ryan, G. W., & Bernard, H. R. (2000). Techniques to Identify Themes in Qualitative Data.

Vygotskii, L. S. (1978). Mind in Society: The Development of Higher Psychologicalprocesses. Cambridge, Mass: Harvard University Press.

Yin, R. K. (2003). Case Study Research: Design and Methods. Applied social research methods series (3rd ed.). Thousand Oaks, Calif: Sage.

Social Interaction in Virtual Teams: An Exploratory Study of Students Undertaking Business Simulation

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Abstract: In recent times, the usage of virtual teams has been accelerated, and virtual teams are being used exponentially in higher education and industry - driven by, and in response to, the Covid-19 pandemic - aided by developments in innovative technologies and globalisation. Teams have suddenly become an essential and necessary approach for collaborative learning as well as task completion. In examining the components of social interaction and its respective distinguished components, this paper positively points to virtual teams being an appropriate means for social interaction and team performance, albeit with some challenges. This qualitative study brings to the fore constructive and affirmative themes, along with various challenges that virtual teams present and also highlights areas for further research.

Keywords: virtual teams, business simulation, higher education, social interaction, e-learning

1. Introduction

In recent years, team work has become an essential part of organisations operating in global economies, and so the business environment has created an imperative for higher education institutions (HEIs) to modify educational programmes in order to prepare students to be effective team players. There is an increased upward trend in the number of universities incorporating a team experience into their curricula (Neumeyer and McKenna, 2016). Even more so now is the pronounced and accelerated usage of virtual teams, utilised by industry and higher education alike, driven by, and in response to, the Covid-19 pandemic; aided by developments in innovative technologies and globalisation. Teams have suddenly become an essential and necessary approach for experiential and collaborative learning as well as task completion.

There are numerous personal, functional, and social benefits associated with team learning, for example, improvement of students' management skills, development of a clear vision of the team culture, understanding different team roles, and increased flexibility at individual and team levels. Further benefits include improved interpersonal skills development, communication, and creativity skills. Conversely, team learning, particularly in an online format, can be challenging due to lack of effective training, communication, and assessment measures. Studies have shown that students do not always have a positive attitude toward team work due to the perceived relationship between team work and effective performance and the lack of social interaction. Other studies highlight the associated challenges of online team work including communication and technical difficulties, levels of social interaction, unequal participation, and an unfair share of responsibility. Current technologies for learning are often designed for functional collaboration (e.g. sharing documents, communicating, etc.) but fail to support social interaction, learning, and understanding group dynamic processes. Research demonstrates that learning and understanding in virtual teams is difficult and the level of communication and learning is different to that of face-to-face. Researchers posit that with virtual tasks, neither the task nor the task environment (i.e. online environment) require leaners to engage in reflective behaviour which give rise to higher levels of learning through social interaction, thus bringing to the fore the focus of this paper – *social interaction in virtual teams*. Social interactions influence a team's ability to be successful (Muethel et al, 2012) in terms of developing good and strong social relationships, which in turn positively impact the teamwork and teambuilding.

2. Social interaction and virtual teams

Social interaction in teams is analogous to 'Teams Mental Modes' (TMM) where team members tend to rely on one another in a cognitively interdependent manner. Theory and research around the concept of social interaction centre on the quality and quantity of interaction and emphasise communication as a key component, often using social interaction and communication interchangeably (Ryan et al, 2013). Social interaction theories provide clear evidence of the importance of developing social interactions for effective team work, with research indicating that social interaction has a generally positive outcome (Bicchieri et al, 2010) and that the type of social interaction matters. The literature (e.g., Mortensen & Hinds, 2001; Hinds & Mortensen, 2005) evidences that trust and strong social identity are essential factors for social interactions to result in a positive outcome.

However, the mechanisms that facilitate either trust or social identities or other identifiers of positive social interactions, and not the least, whether these mechanisms are similar for virtual teams, are not clearly defined, and so… the focus of this particular paper.

Over the years, 'teams' as an organisational concept are discussed in different functions and contexts (Cohen & Bailey, 1997; Helfert, 1998; Hoegl, 1998). Hoegl (1998) defines a team as "*a social system of three or more people, which is embedded in an organization (context), whose members perceive themselves as such and are perceived as members by others (identity), and who collaborate on a common task (teamwork)*". Similarly, Dyer (1987) defines a team as "*a collection of people who must collaborate, to some degree, to achieve common goals"*. Research about team and group dynamics highlights that teams display a high level of interdependency and integration among members (Powell et al, 2004), while in contrast, Cameron & Green (2019) suggest that team members do not rely on each other, but instead perform group activities interactively. In conventional teams, members are located close to each other, allowing for immediate face-to-face communication, thus having an impact on social interaction. Having defined the term 'team' above, virtual teams consider two aspects separately. As stated, the term 'team' describes *"a small number of people with complementary skills who are equally committed to a common purpose, goal"* (Ale Ebrahim et al, 2011). The term 'virtual team' extends this definition defining virtual teams as "*geographically and organizationally dispersed members assembled using a combination of telecommunications and information technologies to accomplish an organizational task"* (Hacker, Johnson, Saunders, & Thayer, 2019). Virtual teams are often formed due to the colocation or dispersion of team members in time and place, operating across multiple, even temporal boundaries. Commonly, virtual teams are coined by a lack of physical and personal contact (Pinto, 2018), thus demanding the use of information and communication technologies to interdependently collaborate toward a joint objective or ask completion. Bell & Kozlowski (2002) distinguished traditional and virtual teams based on two overarching components, namely spatial distance and communication (Bell & Kozlowski, 2002). Virtual teams display a distributed team whose connection is based on technological mediated communication mechanisms (e.g. Microsoft Teams, Zoom, E-mail).

Having defined the concept of 'teams' and 'virtual' teams, we have chosen and applied the theoretical concept of social interaction proposed by Hoegl (1998) in Lechlner (2001), p.268, in the context of virtual teams with a view to ascertaining how social interaction and its components impact on the quality of virtual teamwork. In a rigorous and comprehensive study, Hoegl (1998) measured and demonstrated the quality of teamwork, defined as the collaboration within teams, or the quality of social interaction within the teams. This research distinguishes six components of social interaction: (1) communication, (2) cohesion, (3) work norms, (4) mutual support (5) co-ordination and (6) the balance of member contributions. *Communication* provides the vehicle for information exchange among team members (Pinto & Pinto, 1990) and the quality of communication depends on frequency, formalization, structure and openness of the information exchange (Hoegl, 1998). *Frequency* refers to how often and extensively team members communicate; *formalisation* relates to how much preparation is required before communication occurs in the team (Katz, 1982); *the structure of communication* depends on whether there is direct communication between team members or if the information is communicated through mediators (e.g. team leader); *openness* refers to how openly team members share information in the team. Team cohesion describes the degree to which team members desire to remain in the team. Mullen & Copper (1994) explain three pivotal aspects of cohesion: interpersonal attraction, commitment to the team task and group pride/team spirit. Several authors agree it is unlikely to achieve high team performance without an adequate level of team cohesion (Hoegl, 1998; Mullen & Copper, 1994; Helfert, 1998) as it is imperative for effective team performance. However, research suggests that technology for virtual teams does not provide the same visual, sensory, and olfactory cues that face-to-face interaction does, and therefore may not enable students to synchronize in the same way, and achieve cohesion in the same way as traditional face-to-face teams allow. Norms are defined as shared expectations within a team regarding the behaviour of team members (Levine & Moreland, 1990). Essentially, they are a set of rules that shape team members behaviour and interactions. An understanding of group norms is essential for effective teams as they establish clear, agreed upon behaviour, set out what work need to be done and how it will be done. Furthermore, it sets out the expectations that team members can expect from each other – all key for team success. Mutual support is also considered essential for teamwork (Tjosvold, 1995). The collaboration of team members depends on cooperation rather than competition (Hoegl, 1998). Coordination equally plays a significant contribution within the process of task fulfilment with many activities being delegated within the team. In the main, team members work parallel on different subtasks. These contributions need to be harmonised and synchronised by clearly defining time frames, budget and deliverables. The way in which the team controls these activities influences

the quality of social interaction and also reduces team conflict by balancing members' contributions (Hoegl, 1998). Conflict resolution is also important in terms of social interaction as it refers to the style with which the team handles rising conflicts in situations of high pressure and dynamic contexts. This impacts on how the team resolves potential conflicts before they unfold and negatively impact overall team performance.

3. The research approach

The aim of this study is to explore the components of social interaction in virtual teams in the context of a business simulation game. This section describes the background of the study and the simulation game used, how the data were collected, and the characteristics of the respondents (students).

Business simulation games are representations of real business situations in a virtual environment/world. Business simulation games enhance learning experiences (Matute & Melero, 2016) by providing a context in which students are "learning by doing" (Caulfield et al, 2012). Students perceive that business simulation games help them to develop a range of skills that are highly valued in education and the business world. Some skills are generic competences, such as decision-making, working with uncertainty, and processing and analysing information (Fitó-Bertran et al, 2014). Of relevance to this study, students report enhanced communication skills (Loon et al, 2015), as well as team-working skills, problem-solving, and adaptation to virtual contexts. A strong feature of simulation is its team-based approach, connecting student teams with each other, and to the outside world, allowing individuals and teams to act upon their knowledge and skills, resulting in deep learning. Such pedagogy extends the notion of real-world learning and immerses students in the realities of managing the interlinked functions of managing themselves AND a team. It allows students to apply leadership, and understand the role of strategies in uncertain and unpredictable environments, and the associated cognitive and non-cognitive competencies necessary for success in a virtual team environment (Cooper et al, 2004; Kirby, 2004; Heinonen & Poikkijoki, 2006; Pittaway & Cope 2007; Blenker et al, 2008; Vanevenhoven, 2013). Furthermore, simulations allow students to immerse themselves in the 'real' world of work (Akola and Heinonen, 2006; Lähteenmäki & Uhlin, 2011), forcing them to engage and interact socially with team members in real-time. Simulation also addresses an important dimension of the ever-changing landscape of how businesses operate and in particular the benefits and use of ICT/digital as a learning tool, and as a means of how to use technology in a virtual world to assist in cross functional communications (Tanuri, 2010; White & Le Cornu, 2011; Rai et al, 2012; Bharadwaj et al, 2013).

The business simulation game *(SimVenture)* is introduced to students through a series of online live lectures and seminars conducted through Microsoft Teams in order to provide both the business and technical requirements for simulation completion. Students also attend practice online laboratory sessions to gain familiarity with playing the game. One-to-one team meetings are also organised allowing students to discuss strategy development and report on progress. Each team is also subscribed to a dedicated Microsoft Teams channel - used as the virtual learning space where students can 'share', 'chat', 'upload files', 'meet' and 'send messages', promoting task co-ordination and social interaction.

This study adopts a qualitative approach, gathering data from the class cohort through interviews using a fully standardised questionnaire with open questions at the end of each section. The questionnaire itself was divided into two parts, (1) investigating the profile of respondents, and (2) the components of social interaction. All students (n=48) were invited to participate in the interviews of which 22 students volunteered. Interviews were conducted on an individual basis.

The background profile of respondents was represented by a diverse group of interdisciplinary students across science (4%), engineering (88%) and business (8%). The majority of respondents were male (67%) while 33% were female. The age profile was represented by the largest majority aged 26-30 (47%), followed by 40% aged 20-25. The remaining were aged 31-40, with 10% representing those aged 31-35. A small minority were 36-40. The majority (98%) had previous work experience, with the highest percentage having 3-5 years' experience. While all respondents were completing the programme virtually, 55% were physically located in Ireland. The remaining students were located abroad in India, the United States, China and the UK. Interestingly, all respondents indicated they had previous experience of teamwork, with a significant majority already having virtual teamwork experience.

4. Research findings

The exploration of the empirical results gathered is guided by the components of social interaction proposed by Hoegl (1998), under the key themes of *communication, cohesion, work norms, mutual supports, co-ordination, and balance of members' contributions*.

4.1 Communication

Communication emerged as a distinguishable component of social interaction, with the majority placing significant importance on this. Specific positive responses included: *"communication is the cornerstone of effective teamwork"*; "*managing communication is so important, …Mismanagement of communication leads to misunderstandings"; "honest, open and shameless communication makes for a better team".* The responses highlight respondents recognise the paramount importance of communication (and indeed miscommunication) and its impact on effective teamwork. Open exchange of information is important in terms of social interaction and building effective teams. Challenges regarding communication were also cited, centred around the numerous and various communication mediums available for virtual teams e.g. *"For effective and transparent communication with fellow team members it was necessary to use efficient tools and techniques to communicate…….our team decided to use the following platforms for communication WhatsApp, Trello, Google Data Studio, Sway, Realtime Board, Miro, and Meet"*. Some students felt there were "*too many platforms available", "people have different preferences in terms of how they want to communicate…..some prefer Teams, others Zoom, and others just WhatsApp and e-mail".* This led to tensions and conflict in the team at the outset of the project, and additional tasks for effective team collaboration. Individual comments included: *"we had to choose a platform that suited everyone…..this was difficult as everyone wanted to use different ones"; "I lost a lot of time at the outset of the project as we were all using different ways to communicate which really just caused confusion"; "team members were really frustrated at the start as people were arguing about which platform was the best to use".* Instead of starting team development on a positive note, the communication medium caused tension, whereby members had the added task of choosing a medium that suited all i.e. *"we had to call a meeting with all members to decide on the best way to communicate".* The opportunity to communicate 'live' and 'not live' also presented challenges. Some welcomed the component of live and scheduled communication/meetings, e.g. *"easier to have a live meeting where everybody can talk and discuss project issues together*", "*great to be able to actually communicate with people live…..easier to get your point across".* In contrast, others had a preference for "*logging in when it suits me"* and "*receiving project updates via email",* citing that 'live' meetings were "*very long and time consuming*". Additionally, the communication timing had an impact on the team, mostly attributable to time differences and locations e.g. *"time zones are a big problem in trying to organise a time that suits all team members"*; *"I am working very late into the night in order to meet my team members*".

4.2 Cohesion

Three pivotal aspects of cohesion were explored. Regarding interpersonal attraction, positive comments were received demonstrating positive team cultures and team attraction e.g. *"Building trust among team members is an important aspect while working with virtual teams, however this wasn't a concern in our team since a good rapport was formed within the team in a short span of time; "The team fostered shared leadership and transparent communication leading to increased engagement and productivity";* "*The best part of working as a virtual team with our team was everyone was patient and had that urge to do better in each new quarter run, we never shy away from trying out new things, making new mistakes, carefully mending the previous ones too".* Further, there was a strong sense of commitment to completing the task, evidenced through: "*A collaborative effort from all team members to make key decisions and complete the task at hand to the best of our ability*"; and "*our team had people with specific roles who consistently gave high level of commitments for the purpose of the business simulation*"; Thirdly, group pride/team spirit was an emergent theme, with respondents indicating they *"really enjoyed the process because of the team they were working with… felt great when we made the right decisions".* Added to this was the sense of unity whereby one respondent indicated that *"the team was able to stick together throughout the process and continuously helped each other".* Overall, it appears that there was a strong sense of cohesion amongst the teams, however it should be noted that some respondents cited a lack of '*socially interacting*', being "*deprived of a professional office culture*", the "*online environment was distracting*" and the "*inability to see people's immediate reaction" and "can't see the person and body language*".

4.3 Work norms and co-ordination

In examining the work norms and co-ordination within the team, a varied approach across the teams was evident, with some adopting a formal and structured approach in establishing work norms: "*we had a meeting to set out the overall vision for where the team wants to go together as a unit and set out a solid framework for operation of team activities"; "we drew up a team contract and schedule of activities and deliverables… all team members had to sign this"*. Similarly, another respondent indicated that *"progress meetings were scheduled on a weekly basis, whereby each member presented their key achievements so we all knew what everyone was doing".* Others indicated they had a "*shared folder, which each member was expected to update at the end of every cycle in the game"; "we appointed a team lead who did all the organising around the activities and provided regular updates via e-mail"*. In contrast, some teams appeared to adopt an unstructured approach, perhaps attributable to the fact they were familiar with each other and had established effective group norms through previous projects: "*we all knew each other and how we work together so everyone knew each other's style and that everyone would do the work on time".* Another respondent stated that "*we all want to do well and we know what we have to do… we split the work by asking everyone what they wanted to do",* allowing people autonomy and flexibility over their work. Furthermore, a respondent indicated that "*we are all doing a master's programme so everyone knows the standard of work that is expected and when it needs to be completed",* adding *"no one needs to be babysat… people should be allowed to work to their pace once the task is completed",* echoing previous comments on autonomy and flexibility within teams. Whilst both formal and informal approaches appeared to work, some respondents indicated that co-ordination was hindered by the flexibility that online platforms allow, highlighting that the *"extra flexibility with online can sometimes create scheduling difficulties that impact on productivity as people are working to their own schedules… going to the gym, childcare, etc., and so we had to establish core hours that team members must be available*". This was echoed by another respondent who indicated that "*different individual schedules can lead to meetings at 'unusual' times (outside 9am-5pm) and I felt I had to be available all the time, which wasn't great".*

4.4 Mutual support

Team level support was very strong across all respondents, which was attributed to the team success. This was evidenced through numerous positive comments: "*never felt that I was working on this alone, which really helped";* "*all team members were great to work with and could reach out to someone, day or night if I was stuck"; "good to know you could always WhatsApp someone with a question and one team member would always get back to you really fast"; "found all team members very helpful"; "all our team had a willingness to work/succeed…..we had constant open and honest communication. Every voice is heard and expected to be heard. Sometimes we had to have very long meetings to ensure that all team members are on the same wavelength of understanding".* Only one team expressed negativity in terms of mutual support, highlighting that "*one bad egg spoilt our batch… by not responding to messages, e-mails, meeting requests… offered no help at all - so we just got on with it ourselves".*

4.5 Balance of members contributions

All respondents, with the exception of one individual indicated that all team members made an equal contribution to the completion of the simulation: "*everyone puled their weight on this"; "overall, all team members made an equal contribution to the project… sometimes people were busier than others in the team and we helped each other out"; "everyone did their best on this and supported each other throughout the project to make it successful"; …overall, I felt everyone played an equal part and made an equal contribution".* Conversely, one respondent indicated that "*one person just coasted along and expected everyone else to do their work... working online made it harder to contact this person as they just would not respond".*

Section 5 discusses the findings with a view to drawing relevant conclusions and making some recommendations for educators using virtual teams.

5. Discussion, conclusion, recommendations

The overall aim of this study was to examine the components of social interaction amongst virtual team members completing a business simulation game as part of their master's programme. The experience of virtual teams was a positive student learning experience with encouraging feedback emerging across all components of social interaction, with clear indications that social interaction did take place during task completion. However, students also presented the many challenges they experienced, drawing attention to key

considerations for virtual teamwork, and its facilitation. Communication emerged as a distinguishable component of social interaction on a number of levels including communication platforms choice, 'live' communication, and timing of communication. The choice of communication platform appeared to cause conflict amongst some groups in terms of which platform to choose in order to accommodate *all* student preferences. Thus, it brings to the fore whether students should be mandated to use a prescribed platform selected by faculty/programme co-ordinators. This would be beneficial from a number of perspectives. Firstly, it would reduce the time taken at the outset in making decisions on which platform to use, enabling the task-proper to commence earlier. Secondly, it would allow for standardised communication for all students, and also allowing standardised functionality and features across the virtual platform in which students are working. In addition - and related to platform choice, the respondent data highlights that a variety of formal (e.g. Microsoft Teams, Zoom) and informal (i.e. WhatsApp) platforms are being utilised, begging the question of where is the learning and social interaction *actually* taking place? Is it taking place on formal and monitored platforms (e.g. Microsoft Teams) recommended by the programme co-ordinator or is it taking place in less structured and more informal online settings such as WhatsApp? – an issue that merits exploration in much more detail.

The timing of social interaction also presents varied challenges for students with regard to 'live' communication. Evidently, some students prefer the flexibility that virtual learning offers in being able to engage at a time that suits individual schedules. Others felt that 'live' online communication was more beneficial. Interestingly, the findings note that the increased flexibility that virtual learning affords actually caused more disruption in that all team members' schedules had to be accommodated, resulting in people working outside the norm of core working hours (i.e. 9am-5pm), resulting in some individuals feeling obliged to be available at all times - perhaps having a negative impact on team cohesion. Based on the findings, a proposal to implement a core learning time policy in the programme design to accommodate and manage student expectations could be considered by the programme co-ordinator. This may assist in accommodating all team members' schedules, alleviating potential conflict, leading to improved team cohesion and co-ordination.

Team cohesion was very positive with findings highlighting high levels of collaboration and commitment within the team and to the task at hand, with students displaying a strong sense of unity. However, on reflection, the online environment presented challenges for some students, which impact on social interaction. Students did not have the benefit of seeing people's reactions, body language, or facial expressions and felt they were *"deprived*" of face-to-face contact. This issue may be linked to the choice of virtual platform and the team norms and could be alleviated by setting expectations from the outset that students in virtual teams engage in 'live' sessions, with cameras switched on in an effort to simulate face-to-face team experience as much as possible. With regard to work norms and co-ordination, students adopted both formal and informal approaches in terms of establishing work norms and co-ordinating the project. Students who adopted a more formal approach established team charters and contracts, while some, dedicated 'project managers' to co-ordinate tasks and activities. For teams that adopted an informal approach, it would appear this was effective as a result of trust, and having the benefit of familiarity with team members from previous projects. This informal and less structured approach may not be effective in newly formed teams, hence it may be valuable for educators to encourage students (more especially in newly formed teams) to formalise work norms and task co-ordination through written team contracts/team charters setting out statements of work and responsibility matrix, thus providing clear expectations from the outset for all team members. In addition, the findings demonstrate very high levels of mutual support and commitment coupled with an equitable balance of members' contributions across the teams. It is clear from the responses that there was a strong sense of commitment to both the task and individual team members.

Having examined the components of social interaction and its distinguishable components, the research positively points to virtual teams being an appropriate means for social interaction and team performance, albeit presenting some challenges. This research has brought to the fore constructive and affirmative themes, along with various challenges that virtual teams present. The research also highlights areas for further research, which include a more in-depth investigation of the online learning environment where student interaction takes place (i.e. in this case *Microsoft Teams' individual team channels*). It would be interesting to see the level, frequency, features, and functionality that individual students and their teams use to complete the task at hand.

References

Adair, D. Alman, S.W. Budzick, D. Grisham, L.M. Mancini, M.E. and Thackaberry, A. S. (2014) Many shades of MOOCs. *Internet Learning Journal, 3*(1), 53-72.

Akola, E. and Heinonen, J. (2006) How to support learning of entrepreneurs? — a study of training programmes for entrepreneurs in five European countries. *Paper presented at RENT XX (Research in Entrepreneurship and Small Business) Conference*, 23–24, November, European Institute for Advanced Studies in Management, Brussels.

Ale Ebrahim, N. Ahmed, S. and Taha, Z. (2011) Virtual teams and management challenges. *Academic Leadership Journal*, *9*(3), 1-7.

Bell, B.S. and Kozlowski, S.J. (2002) A typology of virtual teams: Implications for effective leadership. *Group & Organization Management, 27*(1), 14–49

Bharadwaj, A. El Sawy, O.A. Pavlou, P.A. and Venkatraman, V. (2013) Visions and voices on emerging challenges in digital business strategy. *MIS Quarterly*, *37*(2), 633–661.

Blenker, P. Dreisler, P. Meibom Faergemann, H. and Kjeldsen, J. (2008) A framework for developing entrepreneurship education in a university context. *International Journal of Entrepreneurship and Small Business*, *5*(1), 45–63.

Bicchieri, C. Lev-On, L. and Chavez, L. (2010) The medium or the message? Communication relevance and richness in trust games. *Synthese, 176*, 125–147.

Cameron, E. and Green, M. (2019) *Making sense of change management: A complete guide to the models, tools, and techniques of organizational change*. Kogan Page Publishers.

Caulfield, C. Maj, S. Xia, J. and Veal, D. (2012) Shall we play a game? *Modern Applied Science*, *6*(1), 2–16.

Cohen, S.G. and Bailey, D.E. (1997) What Makes Teams Work: Group Effectiveness Research from the Shop Floor to the Executive Suite. *Journal of Management*, *23*(3), 239–290.

Cooper, S. Bottomley, C. and Gordon, J. (2004) Stepping out of the classroom and up the ladder of learning: An experiential learning approach to entrepreneurship education. *Industry and Higher Education*, *18*(1), 11–22.

Dyer, W.G. (1987) *Team building: Issues and Alternatives*, 2nd edition, Addison-Wesley, Massachusetts.

Fitó-Bertran, A. Hernández-Lara, A. and Serradell-López, E. (2014) Comparing student competences in a face-to-face and online business game. *Computers in Human Behavior*, *30*, 452–459.

Hacker, J.V. Johnson, M. Saunders, C. and Thayer, A.L. (2019) Trust in virtual teams: a multidisciplinary review and integration. *Australasian Journal of Information Systems*, 23, 1-36.

Heinonen, J. and Poikkijoki, S.A. (2006) An entrepreneurial-directed approach to entrepreneurship education: Mission impossible? *Journal of Management Development*, *25*(1), 80–94.

Helfert, G. (1998) *Teams im Relationship Marketing - Design effektiver Kundenbeziehungsteams*, Wiesbaden: Gabler Verlag.

Hinds, P J. and Mortensen, M. (2005) Understanding conflict in geographically distributed teams: the moderating effects of shared identity, shared context, and spontaneous communication. *Organization Science*, *16*(3), 290-307.

Hoegl, M. (1998) *Teamarbeit in innovativen Projekten – Einfluflgrößen und Wirkungen*. Wiesbaden: Gabler Verlag.

Katz, R. (1982) The Effects of Group Longevity on Project Communication and Performance. *Administrative Science Quarterly, 27*, 81–104.

Kirby, D.A. (2004) Entrepreneurship education: Can business schools meet the challenge? *Education + Training*, *46*, 510–519.

Lähteenmäki, M.L. and Uhlin, L. (2011) Developing reflective practitioners through PBL in Academic and Practice Environment. In T. Barrett & S. Moore (Eds.), *New approaches to problem-based learning. Revitalizing your practice in Higher Education*, 144–157. New York: Routledge.

Lechler, T. (2001) Social Interaction: A Determinant of Entrepreneurial Team Venture Success, *Small Business Economics*, *16*, 263-278.

Levine, J.M. and Moreland, R.L. (1990) Progress in Small Group Research. *Annual Review of Psychology*, *41*, 585–634.

Loon, M. Evans, J. and Kerridge, C. (2015) Learning with a strategic management simulation game: A case study. *The International Journal of Management Education*, *13*, 227–236.

Matute, J. and Melero, I. (2016) Game-based learning: Using business simulators in the university classroom. *Universia Business Review*, *13*(3), 72–91.

Mortensen, M. and Hinds, P.J. (2001) Conflict and shared identity in geographically distributed teams. International ournal of Conflict Management. *12*, 212–238.

Muethal, M. Siedrat, F. and Hoegl, M. (2012) When do we really need interpersonal trust in globally dispersed new product development teams? *R&D Management, 42,* 31-46.

Mullen, B. and Copper, C. (1994) The Relationship Between Group Cohesiveness and Performance: An Integration. *Psychological Bulletin, 115*(2), 210–227.

Neumeyer, X. and McKenna, A. (2016) Entrepreneurial thinking in interdisciplinary student teams. *Advances in Engineering Education*, American Society for Engineering Education.

Pinto, D. (2018) *Global Virtual Teams : Dynamics of Leadership, Trust, Communication, and Culture*. Retrieved from: http://www.theseus.fi/handle/10024/142345.

Pinto, M.B. and Pinto, J. K. (1990) Project team communication and cross-functional cooperation in new program development. *J. Product Innovat. Manage*., *7*, 200–212.

Pittaway, L. and Cope, J. (2007) Simulating entrepreneurial learning. *Management Learning*, *38*(2), 211–233.

Powell, A. Piccoli, G. and Ives, B. (2004) Virtual teams: a review of current literature and directions for future research. *Advances in Information Systems*, *35*(1), 6-36.

Rae, D. Martin, L.M. Antcliff, V. and Hannon, P. (2012) Enterprise and entrepreneurship in English higher education: 2010 and beyond. *Journal of Small Business and Enterprise Development*, *19*(3), 380–401.

Ryan, S. and O'Connor, R.V. (2013) Acquiring and sharing tacit knowledge in software development teams: An empirical study. *Information and Software Technology, 55*, 1614-1624.

Tanuri, I. (2010) A literature review: Role of social media in contemporary marketing. Retrieved from http://agroovyweb.com/2010/03/11/university-of-chicago-and-myliterature-review-roleof-social-media-in-contemporary-marketing/.

Tjosvold, D. (1995) Cooperation Theory, Constructive Controversy, and Effectiveness: Learning from Crisis. In Richard A. Guzzo and Salas Eduardo and Associates, *Team Effectiveness and Decision Making in Organizations*, San Francisco: Jossey-Bass, 79–112.

Vanevenhoven, J. (2013) Advances and challenges in entrepreneurship education. *Journal of Small Business Management*, *3*, 466–470.

White, D. and Le Cornu, A. (2010) Visitors and Residents: A new typology for online engagement. *First Monday*, *16*(9).

Engagement Challenges in a Hybrid Classroom: Reflections of a Higher Education Tutor

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Abstract: The Covid-19 pandemic required a shift that brought many hybrid classrooms to the doors of tutors. Online video tools were one method utilised in a way to keep classrooms safe due to the need for social distancing. This paper explores the term hybrid learning and how previous studies have implemented online tools within this mode of teaching. The paper will explore some of the common challenges a hybrid learning environment presents when considering student engagement and belonging. A clearer understanding of good practice in using online tools such as chat boxes to encourage student participation is discussed. The challenge of working with students both physically and remote is explored and reflected on. The benefits of a hybrid classroom environment are examined from previous studies and how utilising positive teaching methods can encourage students to stay connected. A holistic reflection on the quick movement towards hybrid is considered. The challenges of hybrid have been considered including how to keep students engaged as lockdowns were eased due to the pandemic.

Keywords: hybrid, engagement, participation, belonging, connectedness, online tools

1. Introduction

As the world started to ease Covid-19 lockdown restrictions it was important to consider the new ways of working in an academic context (Bashir et al., 2021). It was considered a time where major changes could be made to the education sector as we dealt with the norms post pandemic (Guppy et al., 2022). The education system was required to adapt its methods to deal with social distancing and although lockdown restrictions were in place higher education institutions were hesitant to relax its own restrictions (Kinash, Jones and Crawford, 2021, Masamilova et al., 2022). The recent pandemic meant that students had been learning either via distance learning or blended learning as a speedily shift was required to move away from face-to-face teaching to protect people from the virus (Quality Assurance Agency for Higher Education, 2020).

Various institutions which had already taken a digital first approach pre-pandemic was able to make the shift to online teaching with ease (QAA, 2020). Bashir et al. (2021) found that many universities were already attempting to make their courses more flexible. By acknowledging the changes in society and needs of the students some universities had made the decision already to have some courses via blended learning. It is further highlighted by the fact that universities were starting to build campuses without traditional lecture theatres as these were seen to be outdated (Kinash, Jones and Crawford, 2021). This creates the added requirement of educators having knowledge of the technology they are using. Tutors need to look at other professionals to explore current practices which may improve student learning and engagement in what has been described as 'university 4.0' (Morgan, 2020, Cesco et al, 2021, p.290). Guppy et al. (2022) foresees a large educational technology growth post pandemic with the use of different modes such as blended and hybrid learning modes. However, this does not promise that student engagement and satisfaction will be any better, with QAA (2022a) reporting that there was a higher level of dissatisfaction from students who were taught during 2020-21 academic year. This paper sets out to examine the use of hybrid learning post the pandemic and includes reflections of the authors own experience of hybrid teaching post pandemic. The most recent benefits and challenges to supporting student engagement will be reviewed and to conclude future steps for hybrid learning will be recommended as we continue to shift to pre pandemic teaching and learning.

2. Literature review

In this section, the term hybrid will be discussed in an academic setting. A short exploration of recent research will be carried out as hybrid learning has gathered increased attention post the Covid-19 pandemic. A key aspect of hybrid learning is understanding how to maintain a sense of belonging and community for students which will be discussed in the last section.

2.1 Defining hybrid learning

Hybrid learning is a term that can be traced back to Pittman in 1840, who originally identified distance learning as a method to correspond via mail to various students (Tyagi et al., 2021). Since then, there has been many iterations of what a hybrid classroom is. What makes the term confusing is that it was originally used interchangeably with blended learning (Smith and Hill, 2018). Raes et al. (2020) state that a 'hybrid virtual classroom' is where students can participate in a classroom synchronously both on campus and remotely. In addition, Bashir et al. (2021) refers to the model as a 'hyflex model' where lessons can be accessed in person, both synchronously and asynchronously online. It was Beatty in 2007 who created the term hyflex (Bashir et al., 2021). Although hyflex is best described by Beatty (2019, p.30) as "Without meaningful choice, there is no flexibility … and therefore no HyFlex". Both blended learning and hybrid learning definitions demonstrate a non-universal terminology with two variations of overlapping teaching methods. Caution must be taken as pre-pandemic papers used both terms interchangeably, yet it is assumed there will be a shift from this due to pandemic ways of learning. One definition would support understanding and bring clarity to the term. Therefore, this paper will use the term hybrid learning as the standard term which encompasses the similar definitions above of teaching students both face-to-face and online synchronously.

2.1.1 A hybrid environment

Sharma and Fiedler (2004) state that a hybrid environment simultaneously supports individuals and groups to build on learning and knowledge in both structured and unstructured ways. It should involve social and formal learning opportunities to complete complex tasks (Norgard, 2021) A regular classroom environment for a hybrid setting would expect a facilitator to be based physically in the classroom as well as being able to run video software and online virtual learning environments for students to access.

Poskitt et al., (2021) had classrooms which would only ever be allowed to be at 50% capacity and students were expected to wear a face covering with tutors to stay behind a Perspex screen for safety. As UK restrictions eased so did the institutes as they replicated government guidance. The UK government looked at methods to ease out of lockdown which started with the use of 'bubbles', face coverings and regular testing to minimise the spread of the virus (gov.uk, 2021). Smaller classes such as allowing 50% capacity helped to support these measures and enabled the uptake of Hybrid modes of delivery (Bulow, 2022). Hybrid environments promotes inclusivity as students can access learning from any location (Jansen and Rother, 2021; Raes et al., 2020). This provides a wider option to students as they can learn in an environment that they prefer and also gives added benefits such as saving time and money for travel (Tyagi et al., 2021).

2.1.2 A hybrid community

Creating a sense of belonging and community is seen as important. A group of students that can have interactions across both online systems as well as in a traditional environment can stay connected (Rausch and Crawford, 2012). It is understood that balancing both students online and in the class is a difficult task. A natural conferencing system is considered a crucial factor to creating an inclusive environment (Flynn-Wilson and Reynolds, 2020). Lamanauskas and Makarskaitė-Petkevičienė (2021) state that students with access to a device can easily engage, even if ill at home. Vandenberg and Magnuson (2021) study on attitudes of Zoom found that both students and tutors preferred face to face teaching. An implication may have been due to their students being nurses and are typically more practical in nature. Vandenberg and Magnuson (2021) build on work by Serhan (2020) study as 61% disagreed when asked if Zoom helped to participate in class. This does emphasise the fact that tutors need to be highly skilled to give students an even learning experience (Jansen & Rother, 2021). Although studies (Raes, 2022; Serhan, 2020) suggest that conferencing systems may lessen a student learning experience these systems still provide opportunities for students to engage with their class in a flexible manner.

The positives of using a conferencing system are demonstrated by recent studies (Guppy et al, 2021, Manea, Macavei and Pribeanu, 2021; Raes, 2022). The United Kingdom's Higher education regulatory board (QAA, 2022a) states that a virtual conference system has made it easier for students to access their tutors. Stiles, (2007) argued that virtual learning environments do not meet their original functions, with tools like Microsoft Teams and Zoom potentially being better solutions. Conferencing systems build on traditional online management systems, for example with Microsoft Teams offering a video system and chat function that can be accessed at any time. The wider access to lesson material, chat box transcripts and recordings of live sessions creates a

smooth learning experience for students (Lamanauskas and Makarskaitė-Petkevičienė, 2021; QAA, 2022a). The ability to then refer to the material outside of lessons is again a useful clarification tool (Manea, Macavei and Pribeanu, 2021).

Some tutors have been required to deal with dramatic shifts from distance learning to a hybrid model. The speed of transferring from one mode of study to another could create stress which was highlighted by Vandenberg and Magnuson (2021) with 54% of students and 47% of tutors reporting stress and anxiety when working on Zoom.

2.2 Engaging students with online tools

The following two sections will investigate how the use of online tools can help to create a supportive environment. The section will identify some of the challenges that have been found when delivering in a hybrid mode.

Zoom has been seen to have advantages including the flexibility, ease of interaction and being able to use online tools (Serhan, 2020). The learning atmosphere can however have a positive or negative impact on the students' experience (MacLeod, Yang and Shi, 2019). The activities a tutor embeds is expected to help students feel connected with their peers, whichever format they have decided to study in.

The use of items such as microphone and chat boxes need to be enabled so to encourage synchronous conversations that flow (Serhan, 2020). Bashir et al. (2021) support this as student participants claimed that they felt more involved in lessons as they were able to have a better focus and use the chat box function to ask questions. Lamanauskas and Makarskaitė-Petkevičienė (2021) support this as their students were able to access live lectures and confer with tutors and peers instantly via the MS Teams chat function. Effective use of a chat box may potentially help students feel they belong (Flynn-Wilson and Reynolds, 2021). However, it is suggested that non-verbal cues are a constraint when participants are remote (Kepler, 2020). Students could become passive as they lack an understanding as they are not present in the physical environment (Jansen & Rother, 2021). This could create a complex environment, in particular a class with remote students who decline to speak. This may restrict learning and the feeling of being connected with the group if students maintain silence. Serhan (2020) claims that smaller classes allow for students to be able to ask more questions to the tutor.

The use of cameras in the class could reduce the perception of 'distance' in a virtual environment (Miller, Sellnow and Strawser, 2020). The use of cameras may give a sense of facetime that students can get similar access to when in a traditional environment. For some institutions it is possible that a policy for the use of cameras was implemented to encourage participation in class. Those that did use their cameras reported a higher engagement score when they made themselves visible (Raes, 2022). This could lower attendance and a sense of belonging however as those that do not feel comfortable on screen (Bashir et al., 2021) may decide not to attend sessions. The need for tutors to create a positive and comfortable environment is required for students to be able to freely express themselves. Although students with contrasting views of their peers rarely express them due to a fear of being isolated by the group as well as the lack of understanding of when to speak (Flynn-Wilson and Reynolds, 2020; Jansen and Rother, 2021). This is a significant barrier to overcome as a common mistake may be to fill the gap of silence with further input rather than being considerate to those online who could need further time to respond. Overall, it is considered dependent on the type of students in a class that will reflect the experience (Guppy et al., 2022).

2.2.1 The importance of interaction in an online space

Encouraging a sense of belonging for students is a difficult task. Group work may give students a feel of belonging if they are provided with sufficient activities which encourage discussion (Tyagi et al., 2021; MacLeod et al, 2019). With a hybrid environment the feeling of being with their peers can not only be restricted to a physical environment. The use of virtual learning environments to add another layer of communication has found to be useful as collaboration can happen on these types of online platforms (Alexander, Lynch, Rabinovich and Kuntel, 2014). The more a student interacts with a virtual platform the more they prefer that format (MacLeod et al, 2019). This is unsurprising as it would be expected that online learning would become common ground. Gonzalez et al., (2020) found that those students that have been confined are able to carry out more continuous and efficient study. Online tasks can be an issue as those that lack communication skills will suffer. Those unsure how to use the online tools, make friends or attempt to get involved with collaborative activities will no doubt decrease their social interactions (Lamanauskas and Makarskaitė-Petkevičienė, 2021). The use of breakout

rooms or separate channels gives smaller sub-groups ownership whilst working in a hybrid environment. Active discussion can take place as those with devices can communicate. With conference systems such as Microsoft Teams it encourages asynchronous engagement as students can work on a project outside of the classroom. Tutors can then have a wider remit as they can communicate important announcements to students when not delivering live (Lamanauskas and Makarskaitė-Petkevičienė, 2021). Using these methods are potentially key to keeping students engaged and connected with their studies.

As students can see the benefits of continuous interaction this will further their interest. Encouraging early engagement and being a social presence is stated as a key factor to creating a community (Trespalacios et al., 2021). As Masalimova et al. (2022) states that socialisation difficulties are common occurrences in a distance learning environment those similar difficulties are expected to be found in a hybrid environment. It is undeniable that those students that decide to learn in a remote location miss out from the smaller conversations that potentially happen during break periods. This is expected to cause a significant impact when considering how those remote students feel about their belonging and subsequently impact their engagement in the sessions. QAAs' (2022b) report agrees as their findings showed that it was the lack of informal conversations that would increase the feeling of disconnection and impact on their experience. This requires a wider institution approach for frequent informal conversations that the learning environment does not always produce. Items such as virtual quizzes may be useful and could support students that prefer or are required to work off-campus.

3. Experiences in HL

This section will apply this authors experiences in a hybrid learning environment and reflect on the tools used to attempt to heighten student engagement. It will discuss challenges as well as elements of good practice used in a hybrid learning environment post pandemic.

This author found that being in a blended learning university the shift from distance during the pandemic to hybrid as lockdown restrictions eased was swift as communication had been made clear from the institute. This was an important start as the shift to a different mode of teaching required tutors to understand the new mode of teaching (Raes, Detienne, Windey, Depaepe, 2019).

A change from Adobe Connect to Zoom may have presented a technological challenge for some tutors who lack IT skills as it had been decided this would be a better conferencing system to support students. The use of these online conferencing systems has been crucial to continue learning and help groups of students stay connected when the world was at its most fractured point. The need for well-equipped learning practitioners that can guide tutors who have little expertise with conferencing functions becomes increasingly important. Understanding how to simply slide share or make use of the interactive whiteboard was all functions tutors were required to learn so to be able to replicate some of the systems used in a traditional classroom setting.

Communication was sent to students who were given the option to book a table in the classroom (max 50% capacity) or have the choice to engage via Zoom as each classroom was fitted with cameras. This then gave students the freedom and flexibility as they are able to be in class and then re-watch the session if they need further support with their studies. For this author, mature students regularly worked remotely due to other commitments such as work or family. As the easing of lockdown occurred it was still common for there to be more students online due to the fear of transmitting covid-19. For those students who had started their studies during the pandemic class participants were largely online as this was the norm. This environment can be difficult for even skilled tutors when there is a large disparity between those in class and those online. The challenge being to not focus on one mode of learning over the other. Having well-timed interactions was highly important (Raes, Detienne, Windey, Depaepe, 2019). Understanding if particular students online had disengaged required timely intervention as it is easier for them to socially loaf and let those who attend physically to discuss the sessions topics. Use of names and understanding the type of student could help the approach taken with particular students.

For example, students that were generally quiet would have been prompted and encouraged to use the chat box to ensure they were present and on task compared to more confident students who would be happy to use the microphone. The use of cameras helped class engagement and found when majority of students had their camera on, other students would follow suit. It is thought that potentially a camera policy when first rolling out hybrid may have helped which is also suggested by Castelli and Sarvary (2020) when attempting to understand

students' perceptions of camera use in remote classes. This would have improved interactions and helped to engage and stay connected in what was an unfamiliar environment. Yet, this author found that small groups with students that have little to say or choose to not turn on their cameras can create an isolating experience for all involved. Other students can turn this into a positive as those who may be timid may ask more questions when their group is physically smaller.

A hybrid classroom can create an opportunity where tutors and students can have frequent 1-1 sessions without worrying about convenient and quiet spaces. The ability to mute the physical classroom creates opportunity to speak to those in class only and support with any issues. This can help build a rapport with students as you build on those 1-1 sessions (Tyagi et al., 2021). Those online do not get this benefit but there are chances where breakout rooms can be used as safe spaces to support those students learning remotely. Regular 1-1 time is important to ensure remote students are staying engaged and that they are confident in their studies.

Having a hybrid system did have other advantages as sharing files was simply done through Zoom rather than requiring students to log in to VLE's. For those in class, utilising QR codes could ensure students were able to access the same materials that were shared via Zoom. Use of other online software such as Padlet and Mentimeter was found to be easier as those students who only had a desktop computer would be able to collaborate with their peers. Tools like Padlet gives students the opportunity to share opinions and resources they have found engaging. Students can create digital resources which the class can revisit and continue to add to outside of the classroom. These features are then useful to be added to discussion forums as students can easily re-find resources used in class time. Incorporating these tools does take time and can be difficult to demonstrate to those remote students struggling with the different components. Compared to those in class where the ability to direct students on their own devices was beneficial to see what they were doing from their perspective.

Zooms own online polling feature was another method to gain quick feedback on the understanding of students. These tools enabled the use of mobile phones which encouraged engagement (Keengwe, Schnellert and Jonas, 2012) and helped those students in class to enjoy the online activities presented to them as well as those online. Tools such as polls were found to have a higher uptake with those students with little IT knowledge able to access. This could then be a starting point of discussions and help to open or re-engage students after breaks within the sessions. Managing these discussions via virtual hand raising and the chat box (Raes, 2022) was required to ensure those online were able to discuss topics with those physically in class. It can be difficult as a tutor to not automatically question those students physically in class and that can be seen. Managing expectations for students from the first session can help to promote the expectations of the group. A HL system can become strong pillars of future courses, but a holistic level of thinking is required to both support educators and students.

4. Conclusion

A model of HL could be seen as a new opportunity to overcome rather than a new barrier for delivering a quality education. It can also support our students as we take positive applications from the pandemic and add these employability skills to our students. The ability to work in a flexible environment has been a key attribute for employers and the need to manage and work asynchronously has become increasingly important. The idea of a synchronous hybrid delivery has been suggested to now be a top demand of tutors (Kepler 2020; Bulow, 2022).

An expectation is that educational technology will provide the biggest area of progress to improve the learning experience. A HL environment needs to be delicately managed to ensure students feel connected. The context of Hybrid learning is of interest as society returns to a pre-covid way of working. There will continue to be a need for a flexible education, but one which provides an engaging experience and welcomes students in both a physical and online space. As software develops tutors should continue to equip themselves with a wider variety of teaching strategies. The way institutes manage this will be crucial to ensure its success. Yet, it will take some time to truly see if a hybrid environment can support students with a feeling of belonging equally in a synchronous mode of hybrid learning.

References

Alexander, M.M. Lynch, J.E. Rabinovich, T. and Knutel, P. (2014) Snapshot of a hybrid learning environment. The Quarterly Review of Distance Education, 15(1), pp 9–21

Bashir, A. Bashir, S. Rana, K. Lambert, P. and Vernallis, A. (2021) Post-COVID-19 Adaptations; the Shifts Towards Online Learning, Hybrid Course Delivery and the Implications for Biosciences Courses in the Higher Education Setting. *Frontiers in Education*, 6, pp 1-13.

Beatty, B. (2019). *Hybrid-flexible course design*. EdTech Books.

Bülow, M. W. (2022). Designing synchronous hybrid learning spaces: Challenges and opportunities. In E. Gil, Y. Mor, Y. Dimitriadis and C. Köppe (Eds). *Hybrid Learning Spaces*. Springer, USA.

Cesco, S. Zara, Z. De Toni, A. Auhli, P. Betta, G. Evancs, A., and Orzes, G. (2021). Higher education in the first year of COVID-19: Thoughts and perspectives for the future. *International Journal of Higher Education*, 10, no.1, pp 285– 294

Flynn-Wilson, L. and Reynolds, K.E. (2020). Student Responses to Virtual Synchronous, Hybrid, and Face-to-Face Teaching/Learning. *International Journal of Technology in Education*, 4, No.1, p.46

Gonzalez, T., de la Rubia, M.A. Hincz, K. P. Comas-Lopez, M. Subirats, L. Fort, S. and Sacha, G. M. (2020). Influence of COVID-19 confinement in students performance in higher education, *PLoS ONE* 15, No.10, pp 1-23.

Gov.uk (2021) COVID-19 Response: Summer 2021. [online]. [Accessed 2nd August 2022] available at: COVID-19 response

Guppy, N. Verpoorten, D. Boud, D. Lin, L. Tai, J. and Bartolic, S. (2022). The post-COVID-19 future of digital learning in higher education: Views from educators, students, and other professionals in six countries. *British Journal of Educational Technology,* pp 1-16

Jansen, A. and Rother, T. (2021) Synchronous Hybrid Classroom in Continuing Education – Tackling Challenges of Exchange and Networking, *Society 5.0*, Virtual Forum, 22nd to 24th 2021, pp 251- 262

Keengwe, J. Schnellert, G. and Jonas, D. (2012) Mobile phones in education: Challenges and opportunities for learning, *Education Information Technology*, 1-10

Kepler, T. (2020) High school teachers criticize center manager: Glorification of e-learning is dangerous. Available at:https://www.altinget.dk/uddannelse/artikel/gymnasielaererne-kritiserer-centerchef-glorificering-af-e-laering-er-farligt [Accessed 1st June 2022]

Kinash, S. Jones, C. and Crawford, J. (2021) COVID killed the on-campus lecture, but will unis raise it from the dead? The Conversation [online] available at: COVID killed the on-campus lecture, but will unis raise it from the dead? (theconversation.com) [accessed 2 June 2022]

Lamanauskas, V. and Makarskaitė-Petkevičienė, R. (2021). Distance Lectures in University Studies: Advantages, Disadvantages, Improvement. *Contemporary Educational Technology*, 13, No.3, pp 1-16

MacLeod, J. Yang, H.H. and Shi, Y. (2019). Student-to-student connectedness in higher education: a systematic literature review. *Journal of Computing in Higher Education*, 31, pp 426–449

Manea, V.I. Macavei, T. and Pribeanu, C. (2021) Perceived benefits of online lectures during the pandemic: A case study in engineering education, International Journal of Educational Sciences, 4 (3), 35-41

Masalimova, A.R. Khvatova, M.A. Chikileva, L. S. Zvyagintseva, E. L. Stepanova, V. V. and Melnik, M. V. (2022) Distance Learning in Higher Education During Covid-19, *Frontiers in Education,* pp *1*-6

Miller, A.N. Sellnow, D. and Strawser, M.G. (2020): Pandemic pedagogy challenges and opportunities: instruction communication in remote, HyFlex, and BlendFlex courses, *Communication Education*, pp 1-3

Morgan, H. (2020) Best Practices for Implementing Remote Learning during a Pandemic, The Clearing House: A Journal of Educational Strategies, *Issues and Ideas*, 93, No.3, pp 135-141

Norgard, R.T. (2021) Theorising hybrid lifelong learning. *British Journal of Educational Technology*, 52, pp1709-1723

Poskitt, C. Shim, K. Lau, Y. and Ong, H. (2021). Mind the Gap: Reimagining an Interactive Programming Course for the Synchronous Hybrid Classroom, pp1-10 [online] Available at: https://arxiv.org/pdf/2109.09073.pdf [Accessed 2 June 2022].

Quality Assurance Agency for Higher Education (QAA) (2020) How UK Higher Education Providers Managed the Shift to Digital Delivery During the COVID-19 Pandemic. Available at: https://www.qaa.ac.uk/docs/qaa/guidance/how-uk-higher-education-providers-managed-the-shift-to-digital-delivery-during-the-covid-19-pandemic.pdf [Accessed 2 June 2022]

Quality Assurance Agency for Higher Education (QAA) (2022a) From Pivot to Permanent: Examining Lessons Learned from the Shift to Online and Hybrid Teaching and Learning, QAA, Gloucester, available at: from-pivot-to-permanent-examining-lessons-learned-from-the-shift-to-online-and-hybrid-teaching-and-learning.pdf (qaa.ac.uk), [Accessed 2nd June 2022]

Quality Assurance Agency for Higher Education (QAA) (2022b) Made Digital: Exploring Student Engagement and Performance During the Shift to Digital Teaching, Learning and Assessment. QAA, Gloucester, available at: XXXX, [Accessed 8th June 2022]

Raes, A. Vanneste, P. Pieters, M. Windey, I. Noortgate, W. and Depaepe, F. (2020). *Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes*. [online] undefined. Available at: https://www.semanticscholar.org/paper/Learning-and-instruction-in-the-hybrid-virtual-An-Raes-Vanneste/6fcd6f1bc9c5964118519d2ec837714a458d0819.

Raes, A. (2022) Exploring Student and Teacher Experiences in Hybrid Learning Environments: Does Presence Matter?. *Post digital Science Education* 4, pp 138–159

Rausch, D.W. and Crawford, E.K. (2012) Cohorts, Communities of Inquiry, and Course Delivery Methods: UTC Best Practices in Learning—The Hybrid Learning Community Model, The Journal of Continuing Higher Education, 60(3), pp 175-180

Serhan, D. (2020) Transitioning from face-to-face to remote learning: Students' attitudes and perceptions of using Zoom during COVID-19 pandemic. *International Journal of Technology in Education and Science (IJTES)*, 4(4), 335-342.

Sharma, P. and Fiedler, S. (2004) Introducing Technologies and Practices for Supporting Self-organized Learning in a Hybrid Environment, proceedings of I-Know, Austria, 30th June – 2nd July, pp 543-550

Smith, K. & Hill, J. (2018). Defining the nature of blended learning through its depiction in current research. Higher Education Research and Development. *Higher Education Research and Development*, 38, No.2, pp 383-397

Stiles, M. (2007) Death of the VLE?: a challenge to a new orthodoxy, *The Journal for the Serials Community*, 20, (1), pp 31-36

Trespalacios, J. Snelson, C. Lowenthal, P. R., Uribe-Florez, L. and Perkins, R. A., (2021) Community and connectedness in online higher education: a scoping review of the literature, *Distance Education*, 42, pp 5 - 21

Tyagi, M. Singh, K. Goel, N. and Sharma, R. (2021). Hybrid perspectives in higher education. *Cosmos An International Journal of Art & Higher Education*, *10*(2), pp.36-38.

Vandenberg, S. and Magnuson, M. (2021). A comparison of student and faculty attitudes on the use of Zoom, a video conferencing platform: A mixed-methods study. *Nurse Education in Practice*, 54, pp 1-6

Comparing Student High and low Reading Performance With Differentiated Digital Reading Materials

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Abstract: The present study investigates eight Grade-4 classes (9- to 12-year-olds, 52.1% girls) who worked on at least 10 lessons using project RegioDiff material. The study focuses on one of these lessons (including nine text passages and corresponding tasks) and on students with low (19 students, percentile <15) and high reading skills (29 students, percentile > 70). While students were working with the material, screencasts were recorded (30h). The construct "task performance" (processing time, response accuracy, and task engagement) was then analysed using the screencasts. The analysis revealed that the two groups differed significantly in the processing time of two tasks, but not in the total time spent on all nine tasks. Significant differences were revealed also for general task engagement. Task engagement was highly correlated with processing time. Participants with higher reading skills spent more time on the tasks and were more engaged than participants with lower reading skills. However, we did not find any differences in terms of answer accuracy. This indicates that task difficulty and student reading skills were well matched. The study also shows how tasks may be adapted or augmented in order to match the learning environment more closely to student learning needs.

Keywords: differentiation, digital materials, reading skills, screencast analysis, primary school

1. Introduction

In today's classrooms, teachers encounter many different forms of student diversity (Messiou et al., 2020). Students also often differ in terms of their reading skills, even though they are in the same grade level (OECD, 2019). Differentiation and digitalization allow for greater inclusion when teaching in a diverse classroom setting.

In the project RegioDiff, we developed digital materials for primary school content lessons (Paleczek, 2020; Paleczek, Ender, Berger, Prinz & Seifert, 2022). These materials combine factual texts with tasks containing elements that foster reading comprehension (reading strategies, cooperative learning, vocabulary work, etc.). The texts and tasks are differentiated into four different difficulty levels. While all students work on the same topic within a comparable time frame (i.e., one content lesson), the text they read is matched to their reading skills, thus aiding greater inclusion during the lesson (Feyerer, 2012). The digital materials used in the present study are described in the following section. In subsequent sections we then focus on addressing whether students with above average reading skills, and students with strongly below average reading skills, differ in terms of their processing time, response accuracy and task engagement, and how these three constructs correlate with one another. The question of how or whether material might need to be adapted to make it more inclusive was also addressed.

2. The digital learning environment

The RegioDiff digital learning environment is designed to cover different topic areas. Each topic consists of various text passages, where, usually, each passage is linked to a corresponding task right after or before reading the text passage. The different types of tasks provided are all known to support students' reading comprehension.

Students first enter a code in order to access the digital learning environment. They then see the topics prepared by the teacher on their tablets. Students choose their assigned level by clicking on the appropriate fruit symbol (see Figure 1) and start working on the topic individually. At certain points, students cooperate

across reading levels in order to solve tasks. Working in such a digital learning environment requires access to an internet connection. The differentiated texts and tasks are now described in more detail below.

percentile rank	reading performance	fruits	approximate number of words per differentiation level
>70	above-average	apple 	750
31-70	average	cherry 	575
15-30	below-average	pear 	350
<15	severely below-average	grapes 	250

Figure 1: Reading levels

2.1 Differentiated texts with glossary words

Each topic consists of various text passages that are differentiated into four reading levels (see Figure 1). On the one hand, the differentiation is based on word count, with the number of words decreasing as one moves from the highest to the lowest reading level. On the other hand, the words, sentences, and texts also vary in terms of their complexity (using fewer complicated synonyms, fewer nested sentences, etc.). Table 1 shows two different levels (the highest differentiation level (hdl) and the lowest differentiation level (ldl)) for the topic used in the present investigation.

Table 1: ldl and hdl reading text information

Passage	Title	Word-count (hdl/ldl)	Sentence-count (hdl/ldl)	Passive sentences (hdl/ldl)	gSmog (hdl/ldl)	RIX (hdl/ldl)	Glossary Words (hdl/ldl)
1	The city Graz	58/17	6/2	0/0	5.42/4.71	2.89/2.72	5/1
2	Districts of Graz	35/14	4/2	0/0	4.71/3.48	2.74/2.41	1/1
3	The coat of arms of Graz	49/28	5/5	0/0	4.48/1.46	3.90/2.15	3/3
4	Center of Graz	110/21	10/1	1/0	6.12/10.25	4.10/4.36	12/4
5	Eggenberg Palace	142/80	13/10	0/0	5.29/3.72	4.81/3.49	8/4
6	Kunsthaus Graz	98/21	8/2	0/0	5.50/3.48	5.29/3.02	7/3
7	Island in the Mur	73/29	7/3	2/0	6.02/3.48	4.42/2.87	5/2
8	The castle Hill and the clock tower	159/66	14/8	2/0	5.02/3.81	5.39/3.65	4/2
9	Graz Cathedral	46/18	4/2	2/0	5.25/3.48	4.17/2.77	6/2
Graz hdl	Whole Text incl. headlines (6 words)	775	70	7	5.49	7.69	51
Graz ldl	Whole Text incl. headline (6 words)	300	36	0	3.85	4.90	22

Difficult words are marked in the texts as glossary words. These words can be specific content-related vocabulary, places (countries, cities, rivers, etc.), persons etc. that students might be unfamiliar with. Students obtain explanations of such terms by clicking on them. A pop-up-window then opens and offers a written explanation, a picture (if possible) and an audio of the explanation in order to ease understanding. The latter feature is especially helpful for weak readers. The explanations are the same for all reading levels. Figure 2 shows a sample pop-up window for a glossary word. Figure 3 shows the same passage in the learning environment, comparing hdl and ldl reading level.

At the beginning of each text passage, students are asked to read the passage carefully and then to click on the button that leads them to the text-related task.

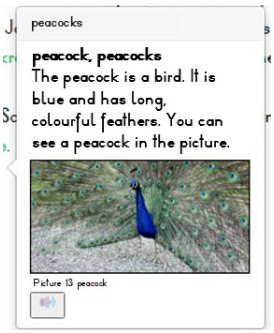

Figure 2: Example for a glossary word pop-up-window

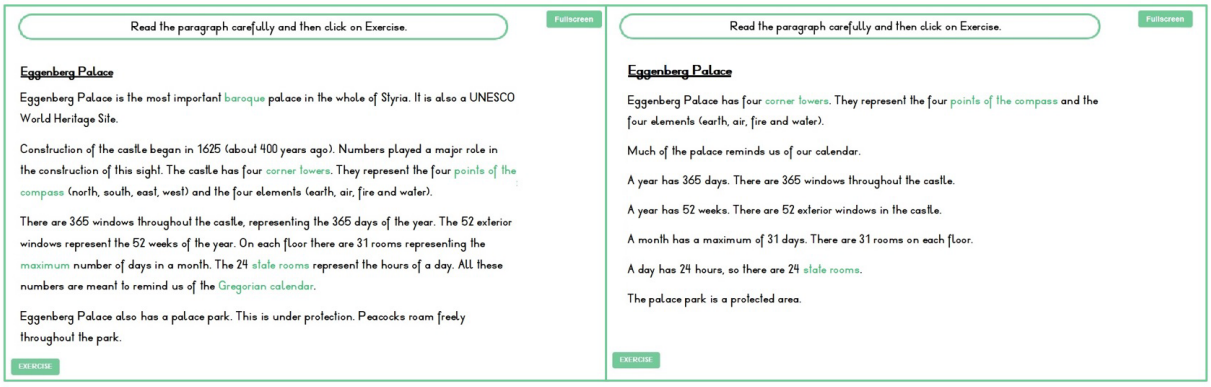

Figure 3: Example for a text passage hdl (left) and ldl (right)

2.2 Tasks

There are different task formats following the text passages. In general, the tasks are either reading strategy tasks (e.g., Duke et al., 2021), cooperative learning tasks (e.g., Hattie & Zierer, 2019), or reading comprehension tasks (e.g., cloze texts, judging whether statements are true or false; Duke et al., 2021). All such tasks are known to foster reading comprehension. Usually, the tasks are also differentiated into four difficulty levels. Only the first and the last task are the same for all differentiation levels. The first task always involves a pre-reading strategy (predicting content by the heading) paired with a cooperative learning exercise (think-pair-share). The last task is the balloon game (see Figure 4) in which students have to answer a text-related question by clicking on the correct letters in order to fill the boxes provided. Clicking on wrong letters makes the balloons burst. As soon as the task is solved, the balloons fly into the air.

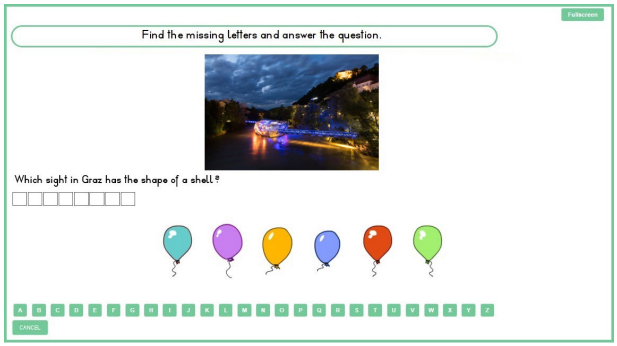

Figure 4: Balloon exercise

2.3 Reading levels and differentiation

Reading abilities within a classroom differ even though children are taught at the same grade level (Paleczek, 2020). The RegioDiff reading material offers four differentiation levels. To decide on the appropriate differentiation level, prior to beginning the study, student reading comprehension was measured using the GraLeV Reading Comprehension Test (Paleczek, Seifert, Franz, Wohlhart, & Riedl, in prep.; Seifert & Paleczek, 2021). The GraLeV was developed to assess the reading comprehension of learners in Grades 3 and 4 and it

consists of four subtests (one at word level, one at sentence level, and two at the text level). The number of correctly solved tasks in a certain amount of time is converted into percentile ranks, which are then used to determine the appropriate differentiation level of the text for each child. For example, if a child achieved a percentile rank of 60, 60 percent of participants performed worse or the same and 40 percent performed better (Paleczek & Seifert, 2021). Children with a percentile rank of 70 or above were classified as achieving above-average reading performance (hdl), and those at a percentile rank below 15 were placed in the severely below-average reading level (ldl) (Paleczek, 2020). Further information on the reading levels is provided in Figure 1.

Differentiating the texts makes it possible for all children in a class, regardless of their reading level, to work on the same topic and thus to acquire knowledge together (Seifert, Schwab & Gasteiger-Klicpera, 2014). Providing the text at different levels of difficulty is intended to make it possible for all students to read the text in approximately the same amount of time (i.e., in one lesson for both the text and the tasks). Moreover, in terms of Wygotski's zone of proximal development (Wygotski, 1987), student reading of a text matched to their own reading abilities facilitates the development of reading comprehension.

2.4 Lessons

Once teachers hand out the tablets, the students can start work immediately. They start with the first reading task (as described above). This activates prior knowledge and facilitates pre-reading conversation with the whole classroom. Students then work individually on the tablets focussing on their own texts and tasks. Each time they get to a cooperative task, they have a look around to see who of their classmates is available and pair up to work on the cooperative tasks. This is not dependent on differentiation levels. It is recommended that the whole class finish the lesson together. This provides an opportunity for post-reading conversation on the topic and thus helps to deepen knowledge acquisition.

3. Aims and research questions

The aim of the present paper is to investigate how students of different reading levels interact in the learning environment and whether it is possible to offer inclusive lessons with such material. To investigate this, we chose one topic (Graz) and analysed screencasts from hdl and ldl readers.

Student task performance (consisting of processing time, response accuracy and task engagement) was thus evaluated. The focus was on readers with above-average (working with the hdl) and severely below-average (working with the ldl) reading skills (Paleczek, 2020). It was thought that differences in processing time between and within groups would provide insight into how materials might be adapted or improved. It was thus of particular interest to investigate whether there was a relationship between processing time and response accuracy, and how students from the ldl and the hdl differed in this regard.

This led to the following research questions:

- 1. What are the respective differences, in terms of task performance, when hdl and ldl readers interact in the learning environment?
- 2. What should be adapted in the digital learning environment to enable students from these two reading levels to work together on a topic?

4. Methods

4.1 Sample

Eight Grade 4 classrooms (N = 131 students) used the digital material on their tablets after parents' consent to take part in the study. In the present study, we concentrated on those students assigned to the ldl (n = 24) and to the hdl (n = 32). After eliminating incomplete, faulty, or inadequate data (e.g., arising from students turning off the screencast prematurely, technical problems, student absence), 48 screencasts remained for analysis (ldl 19 (9 female) and hdl 29 (16 female) students), providing a total of approximately 30 hours of video material.

The students attended Grade 4 primary school and were between nine and twelve years old. Regarding the children's first language (L1), 70.8% were L1 learners (ldl: 52.6%; hdl: 82.8%).

4.2 Design and procedure

For the screencasts, the program "AZ Screen Recorder - No Root" was installed on the tablets to record the screen while students were working in the digital learning environment. The screencast program was started before the lesson began. Prior to the recording, students had already worked on between three and five digital texts. This was to ensure that everyone was able to orient themselves within the learning environment and to reduce any bias that might occur due to lack of familiarity.

The construct *task performance* was defined in advance as being a proxy for student behaviour in the learning environment. Task performance consists of three categories: 1) processing time, 2) response accuracy, and 3) task engagement. These were all determined by means of the screencasts.

For the *processing time*, the start and end time of a text passage task was noted and its duration was calculated. This procedure was based on Baum et al. (2019) and Fadljević et al. (2020).

Additionally, we added the student scores. Since the two differentiation levels differed in the total number of scores students could achieve (28 and 46 for ldl and hdl, respectively), we calculated percentages (*response accuracy*). For Exercises 2 and 5, which involved solving the task in the booklet instead of in the digital learning environment itself, students automatically received 100% as soon as the task was completed. For example, in Exercise 5, learners had to write sentences and read them to another child.

For the category *task engagement*, we captured the students' response behavior. For this purpose, we used an ordinal scale: "3" meant that the task had been solved independently and completely; "2" meant that the task had been solved partially or with help (for example, from a classmate); "1" was selected when children had not solved the task or when someone else had solved it for them. The audio data from the screencasts were the main source for determining task engagement scores. Children's statements were used to track whether and how a child had solved the tasks. This category seems particularly significant with regard to Exercise 2 and Exercise 5, as these are not digitally solvable tasks. For statistical analyses, a sum score was formed (maximum 27: three points for each of the nine exercises).

4.3 Analyses

In addition to one of the authors of the present paper, seven interns of the RegioDiff project, who were trained in advance by the author, were responsible for analysing the screencasts. In order to calculate interrater reliability, all interns evaluated the same screencast after their training. Interrater reliability as indicated by Cohen's Kappa coefficient, shows how much the evaluators assigned the same value to the measured variables (Grouven et al., 2007; Hemmerich, 2019). For the evaluated data, the level of agreement between an evaluator and the author was then checked. Since the available evaluation data are partially interval-scaled, the linearly weighted kappa was calculated. According to Altman (1991), a kappa value of .60 or higher is good; .80 or higher is very good (Hemmerich, 2019). For the screencast evaluated, it was between .873 and .952 (see Table 2), which is why no further training or adaptation of the procedure was required and the evaluators then assessed further screencasts independently.

Table 2: Linearly weighted Cohen's kappa to test interrater reliability.

Rater	Cohen´s Kappa (linear weighting)
1	.927
2	.945
3	.91
4	.891
5	.952
6	.873

Descriptive analyses, mean comparisons and correlations were conducted using SPSS. Since the samples were smaller than 30, a test for normality was performed (Shapiro-Wilk test: Shapiro & Wilk, 1965, cited in Hemmerich, 2021). The categories *processing time* and *answer accuracy* were not normally distributed ($p < .001$), so that a non-parametric test (Mann-Whitney U test) was used (Bortz & Döring, 2016). Mann-Whitney U tests were also used for the ordinal data on *task engagement* (Pospeschill & Siegel, 2018). Additionally, a Bonferroni correction was made.

5. Results

Table 3 gives descriptive data on task performance, operationalised by processing time, answer accuracy and task engagement for both differentiation levels. The results for these indicators are described separately in the following sections.

Table 3: Descriptives for ldl and hdl

Differentiation Level		***Time spent in learning environment in min***	***Processing time per task in sec***	***Mean Percentage of scores achieved per task***	***Task engagement***
ldl (n=19)	Mean (SD)	25.91 (12.57)	70.41 (45.49)	87.32 (17.84)	23.90 (2.99)
	Minimum	4.97	13.00	42.86	17.00
	Maximum	48.48	169.44	100.00	27.00
hdl (n=29)	Mean (SD)	28.54 (8.33)	100.40 (34.91)	90.46 (10.46)	26.21 (1.31)
	Minimum	15.43	46.44	65.29	23.00
	Maximum	49.28	161.67	100.00	27.00

5.1 Differences between ldl and hdl interaction in the digital learning environment

5.1.1 Processing time

As can be seen in Table 3, the range of processing time was very large in both groups. Thus, the students' processing time differs not only between but also within groups. The largest range was seen for the time taken to complete tasks among those in ldl (13.00 to 169.44 seconds per task).

An overview of the individual tasks helps provide insight into how the learning environment may be adapted and into the differences arising concerning student interaction with it. Figure 5 shows the processing time per task for both groups. For each task and level, there is a boxplot showing the range, the median and the first and third quartile. The points above and below are outliers, i.e., the particularly low and high values, respectively (Kohn, 2005).

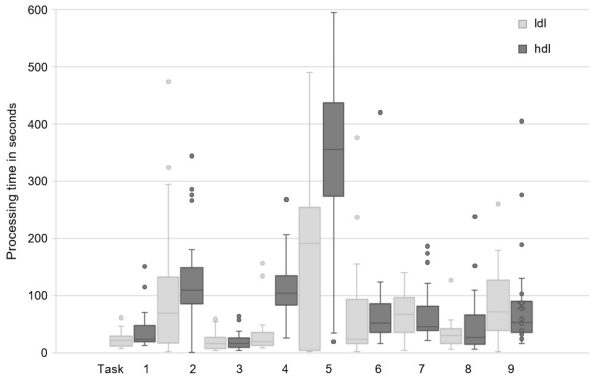

Figure 5: Boxplots of the processing time per task in ldl and hdl readers

As can be seen in Figure 5, there are clear differences between the groups in the tasks 2, 4 and 5. However, after applying a Bonferroni correction of the alpha-level (.005), the Mann-Whitney U tests showed a statistically significant difference only between the two groups in Task 4 ($U = 51.0$, $Z = -4.74$, $p < .005$) and Task 5 ($U = 110.0$, $Z = -3.49$, $p < .005$). No difference was detected in the total time the two groups spent reading and solving tasks in the learning environment.

Task 4 was a cloze text (see Figure 6) and in Task 5, the participants had to write an info box about a famous Graz landmark described in the text. In Task 5, about 75 percent of ldl finished within 250 seconds, while 75 percent of level hdl finished within 435 seconds.

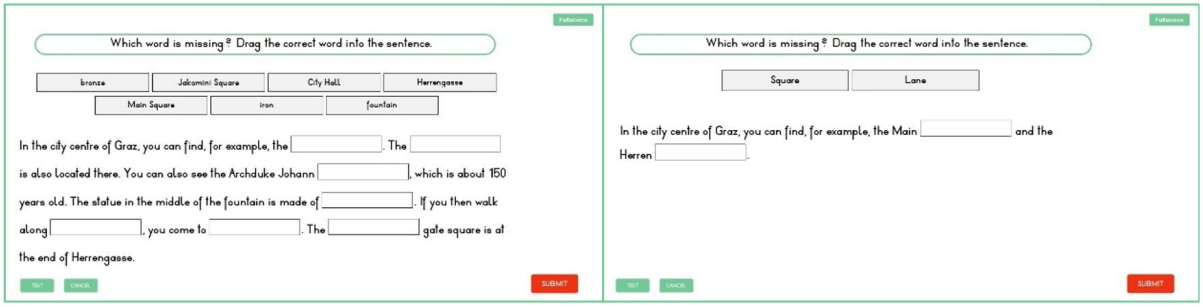

Figure 6: Cloze text in hdl and ldl

5.1.2 Response accuracy

With regard to average response accuracy, there is a difference of 3.14 percentage points between the groups. Table 4 shows the response accuracy for each task. As response accuracy has no validity for Tasks 2 and 5, they are excluded from the table. Both groups scored the lowest in Task 7, in which the correct word had to be selected from three in a cloze text (see Figure 7). In none of the exercises did the two groups differ significantly in terms of response accuracy.

Figure 7: Cloze text with word selection in hdl and ldl

Table 4: Descriptives for percentage of response accuracy per task

task	*ldl* **Mean** (SD)	*hdl* **Mean** (SD)
1	**97.37** (11.47)	**94.83** (13.98)
3	**94.74** (22.94)	**96.55** (18.57)
4	**89.47** (31.53)	**86.03** (18.70)
6	**84.21** (37.46)	**94.48** (14.04)
7	**76.63** (38.62)	**84.14** (19.55)
8	**84.21** (23.88)	**86.62** (22.63)
9	**84.89** (21.65)	**90.59** (16.26)

5.1.3 Task engagement

Task engagement shows the students' response behavior. A maximum task engagement score of 27 points was possible (9 tasks, each a maximum of 3 points). A Mann-Whitney U test revealed a significant difference in overall task engagement between the groups (U = 142.5, Z = -3.035, p = .002), with students in ldl scoring 2.31 points lower than those in hdl (see Table 4).

Frequency analyses of task engagement among those who achieved the maximum number of points provide an overview of the maximum engagement per task (see Figure 8). It was found that only 52.6% in ldl (hdl: 86.2%) were capable of solving Task 2 fully and independently. In Task 6, all hdl readers achieved full points for task engagement.

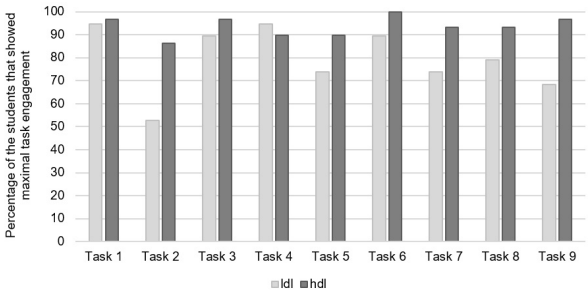

Figure 8: Proportion of participants achieving the maximum number of points in task engagement, separately for both differentiation levels

5.2 Correlations

Task engagement correlated highly significantly with the response accuracy (Spearman's ρ = .48, p < .001). Thus, students scored higher when they were more engaged. There is a medium correlation (Cohen, 1988) between processing time and task engagement (Spearman's ρ = .35, p = .015). The correlation between processing time and response accuracy was r = .34 (p = .018), which also indicates a medium level of correlation (Bortz & Döring, 2016; Cohen, 1988).

Figure 9 shows the time required for the exercises on the X-axis, and the achieved scores in percent on the Y-axis. The two groups are similarly distributed, although there are two ldl readers who clearly spent less time and solved fewer tasks correctly than others. Most students finished the last task between minute 20 and minute 30. The graph also shows that children who took at least 40 minutes solved at least 80 percent of the tasks correctly.

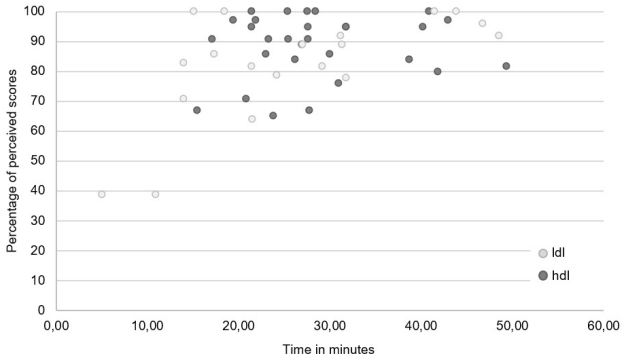

Figure 9: Required time and percentage of perceived scores

6. Discussion

The screencast analysis conducted on one project RegioDiff text (about the city of Graz) provides hints on how the digital learning environment can be adapted so that students of the two reading levels can work together on the materials. The construct task performance was used to compare the work of the below-average readers (the ldl group) with that of those with high reading skills (the hdl group). Task performance consisted of three categories, namely, processing time, response accuracy, and task engagement. The group comparisons showed that the groups did not differ significantly in terms of total processing time spent in the digital learning environment. In general, this thus supports the belief that the material facilitates inclusive lessons where all children learn about the same topic in a similar amount of time, albeit with materials fitting their own reading level. However, there were differences between the groups on specific tasks. The biggest difference in processing time was in Task 5, in which an information box on a Graz landmark had to be created. The ldl readers had to write two sentences and the hdl readers five sentences. It is thus understandable that ldl students completed the task faster. In order to equalize the time needed to complete the task, the number of sentences required for the ldl group could therefore be increased to three. A similar solution could be arranged for Task 4 (cloze text). By adding a sentence to the ldl cloze text, the two groups could perhaps work on the exercise for approximately the same amount of time.

The fact that students in both groups showed the same response accuracy shows that the difficulty level of the tasks was matched to the students' needs in the respective groups. On average, participant task accuracy was between 76% and 97%. Thus, according to Klieme et al. (2010), it can be concluded that the tasks were not too difficult, and that self-directed reading was successful. The most difficult exercise was Task 7. Nevertheless, 76.63% (ldl) and 84.14% (hdl) of the participants were able to solve it correctly.

For task engagement, which represents the response behaviour, it can be concluded that the students in hdl were slightly more engaged and were thus able to solve the tasks more independently compared to ldl readers. One of the reasons for the lower task engagement of weaker readers could be a lack of reading motivation (Brügelmann, 2020). It might be possible to compensate for this by adding more motivational elements to the digital learning environment. The task settings could also be specifically adapted to address the ldl readers, for example, in Task 2. In this task, students had to write down the names of districts of Graz that begin with a G. During the evaluation, we noticed that many children clicked on "submit" in this exercise without actually solving the task. To simplify solving the task, the district map of Graz, which was originally placed beside the text, could also be added to the task itself. Adding the possibility for students to change the font and the font size, as Bosse (2017) suggests, could also be introduced. This would make the learning environment even more individualized. Additional elements could also be added to stimulate task completion among the less motivated students, e.g., by providing direct feedback through star ratings (Grünberger, 2014).

The correlations found between task engagement and response accuracy showed that response behaviour and scores achieved were related. As children who do not engage in a task, or solve it only incompletely, receive no or few points, such correlation is to be expected. As task engagement correlated highly with score achievement and moderately with processing time, it can be concluded that hdl readers needed slightly more time, but scored higher than ldl readers. Fadljević et al. (2020) also concluded that more points were achieved when learners spent more time on a task. However, using RegioDiff as an example, it is difficult to say whether the shorter processing time is due to low task engagement or to the given level of the task or text (text length, complexity). How long students spend on a text and its corresponding task always depends on individual characteristics (interest, motivation, prior knowledge). Therefore, the level of cognitive activity or task engagement cannot always be inferred from the measured time (Christmann, 2002).

Task performance was deliberately operationalized in this paper to capture several characteristics that might be important in assessing student interaction with the learning environment. Distinguishing between processing time, answer accuracy, and task engagement, made it possible to identify several characteristics that are significant in such interaction. Adding further (assessment) categories is likely to provide even more insight. For example, Ozuru et al. (2007) found that accessing the text during the reading task resulted in less activation of prior knowledge. Schaffner and Schiefele (2013) reached a similar conclusion when they found that children scored lower on reading comprehension checks when they were able to read up on the text. Despite this, in RegioDiff, the decision was made to allow access to the text. In this way, the children have the opportunity to look up passages in the text if they are unclear or while working on the reading tasks. Clicking back to the text was noted in the evaluation, but not considered further in the construct task performance. A more detailed consideration of this aspect would be interesting in more in-depth research.

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References

Baum, K., Kirsch, N., Reese, K., Schmidt, P., Wachter, L. and Wolf, V. (2019) "Informatikunterricht in der Grundschule? – Erprobung und Auswertung eines Unterrichtsmoduls mit Calliope mini", In: A. Pasternak, ed., Informatik für alle, Lecture Notes in Informatics (LNI), pp.49-58, Gesellschaft für Informatik, Bonn.

Bortz, J. and Döring, N. (2016) *Forschungsmethoden und Evaluation: In den Sozial- und Humanwissenschaften* (5th ed.), Springer-Verlag, Berlin.

Bosse, I. (2017) "Gestaltungsprinzipien für digitale Lernmittel im Gemeinsamen Unterricht. Eine explorative Studie am Beispiel der Lernplattform Planet Schule", in K. Mayrberger, J. Fromme, P. Grell & T. Hug (Eds.), *Jahrbuch*

Medienpädagogik 13: Vernetzt und entgrenzt – Gestaltung von Lernumgebungen mit digitalen Medien (pp 133-149). Springer Fachmedien Wiesbaden.

Brügelmann, H. (2020) "*Leises und funktionales Lesen stärken! Empirische Studien zeigen: Leseförderung lebt von einem reichen, didaktisch strukturierten Methoden-Repertoire - braucht aber auch eine klare pädagogische Haltung"* (2nd ed.) https://www.pedocs.de/volltexte/2020/20356/pdf/Bruegelmann_2020_Leises_und_funktionales_Lesen_II.pdf

Cohen, J. (1988) *Statistical Power Analysis for the Behavioral Sciences, 2nd ed.,* Routledge, New York.

Christmann, U. (2002) "Methoden der Verstehens- und Verständlichkeitserhebung", *Zeitschrift für Literaturwissenschaft und Linguistik* (128), pp 76–97.

Duke, N. K., Ward, A. E. and Pearson, P. D. (2021) "*The science of reading comprehension instruction", The Reading Teacher, 74*(6), pp 663–672. https://doi.org/10.1002/trtr.1993

Fadljević, L., Maitz, K., Kowald, D., Pammer-Schindler, V. and Gasteiger-Klicpera, B. (2020) "*Slow is Good: The Effect of Diligence on Student Performance in the Case of an Adaptive Learning System for Health Literacy"*, LAK '20: Proceedings of the Tenth International Conference on Learning Analytics & Knowledge, pp 112–117. https://doi.org/10.1145/3375462.3375502

Feyerer, E. (2012) "Allgemeine Qualitätskriterien inklusiver Pädagogik und Didaktik", *Zeitschrift für Inklusion-online.net*, 3, [online], http://www.inklusion-online.net/index.php/inklusion-online/article/view/51/51 [25.05.2022].

Grouven, U., Bender, R., Ziegler, A. and Lange, S. (2007) "Der Kappa-Koeffizient [The kappa coefficient]", *Deutsche medizinische Wochenschrift*, 132, Art. 23, pp 65-68. https://doi.org/10.1055/s-2007-959046

Grünberger, N. (2014), "Räume zum Flanieren, Spielen und Lernen: Überlegungen zur Gestaltung von Bildungs- und Lernräumen im Kontext kultureller Entwicklungen", in K. Rummler (Ed.), *Medien in der Wissenschaft: Bd. 67. Lernräume gestalten - Bildungskontexte vielfältig denken, (p*p 56-67). Waxmann, Münster.

Hattie, J., and Zierer, K. (2019) *Visible learning insights*, 1st ed., Routledge, London. https://doi.org/10.4324/9781351002226

Hemmerich, W. (2019) "*StatistikGuru: Cohen's Kappa für zwei Rater berechnen",* [online], https://statistikguru.de/rechner/cohens-kappa-zwei-rater-berechnen.html

Hemmerich, W. (2021) "*Normalverteilung in SPSS prüfen: Shapiro-Wilk-Test",* [online], https://statistikguru.de/spss/gepaarter-t-test/normalverteilung-ueberpruefen-3.html

Klieme, E., Artelt, C., Hartig, J., Jude, N., Köller, O., Prenzel, M., Schneider, W. and Stanat, P. (Eds.) (2010) *PISA 2009: Bilanz nach einem Jahrzehnt,* Waxmann Verlag, Münster.

Kohn, W. (2005) *Statistik: Datenanalyse und Wahrscheinlichkeitsrechnung. Statistik und ihre Anwendungen*, Springer-Verlag Berlin Heidelberg.

Messiou, K., Bui, L. T., Ainscow, M., Gasteiger-Klicpera, B., Bešić, E., Paleczek, L., Hedegaard-Sørensen, L., Ulvseth, H., Vitorino, T., Santos, J., Simon, C., Sandoval, M. and Echeita, G. (2020) "Student diversity and student voice conceptualisations in five European countries: Implications for including all students in schools", *European Educational Research Journal, 21*(2), pp 355–376. https://doi.org/10.1177/1474904120953241

OECD. (2019) *PISA 2018: Was Schülerinnen und Schüler wissen und können* (1st ed.), wbv Media. https://elibrary.utb.de/doi/book/10.3278/9783763962983

Ozuru, Y., Best, R., Bell, C., Witherspoon, A. and McNamara, D. S. (2007), "Influence of Question Format and Text Availability on the Assessment of Expository Text Comprehension", *Cognition and Instruction, 25*(4), pp 399–438. https://doi.org/10.1080/07370000701632371

Paleczek, L. (2020) "How to Produce and Acquire Regional Knowledge Digitally and in Print: Conceptualisation of the RegioDiff-Project", in C. Busch, M. Steinicke, and T. Wendler (Eds*.), Proceedings of the 19th European Conference on e-Learning, (pp 611-614).* Academic Conferences International Limited, Reading.

Paleczek, L., Ender, D., Berger, J., Prinz, K., and & Seifert, S. (2022) „A feasibility study of digital content use in inclusive, Austrian primary school practice", *International Journal of Educational Research, 112*. https://doi.org/10.1016/j.ijer.2022.101938

Paleczek, L., and Seifert, S. (2021) „Diagnostik als Basis für Förderung: der Grazer Leseverständnistest", *Sprachtherapie aktuell: Forschung – Wissen – Transfer, 8(2),* e2021-36.

Paleczek, L., Seifert, S., Franz, A., Wohlhart, D., and Riedl, S. (in prep.) *„GraLeV: Grazer Leseverständnistest [Graz reading comprehension test]",* open access.

Pospeschill, M. and Siegel, R. (2018) *„Methoden für die klinische Forschung und diagnostische Praxis",* Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-54726-7

Schaffner, E. and Schiefele, U. (2013) "The prediction of reading comprehension by cognitive and motivational factors: Does text accessibility during comprehension testing make a difference?", *Learning and Individual Differences, 26*, pp 42–54. https://doi.org/10.1016/j.lindif.2013.04.003

Seifert, S., and Paleczek, L. (2021a) "Digitally Assessing Text Comprehension in Grades 3-4: Test Development and Validation", *Electronic Journal of e-Learning, 19(5*), pp 336-348.

Seifert, S., Schwab, S., and Gasteiger-Klicpera, B. (2014) „Ein Konzept für differenzierten Leseunterricht in heterogenen Klassen", *Sprache Stimme Gehör, 38,* pp e21-e27. https://doi.org/10.1055/s-0034-1370988.

Wygotski, L. (1987) *Ausgewählte Schriften. Arbeiten zur psychischen Entwicklung der Persönlichkeit: Bd. 2,* Pahl-Rugenstein, Köln.

Investigating Teachers' Transition From Traditional to Online: A Case Study on Accounting Teacher Perspectives

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Abstract: The COVID-19 pandemic has significantly impacted online education, increasingly converting traditional classrooms to fully online platforms. Consequently, a progressing country in the global south, Sri Lanka, has undergone a challenging period during this transition due to various social, economic, and cultural influences. Focusing on the rapid change within Higher Education in Sri Lanka, this paper aims to empirically investigate teachers' perceptions of online education provisions and challenges during the pandemic that can be utilised for effective and efficient technology-enhanced learning. The study was based on a thematic analysis of interview data from eight teachers in the subject area of accounting. Their experience regarding the transition from the traditional classroom to online education is captured under four main themes, students' behaviour in the online setting, teachers' approach to handling the online environment, institutional support, and teachers' perceived effectiveness of online education. The identified experiences are utilised to benefit future online teaching and learning of accounting in an effective and efficient, technologically enhanced environment.

Keywords*:* online education, accounting teachers, online transition, teachers' perspective, transactional distance, Covid-19

1. Introduction

Online education is predicted to be the norm of education provision in the digital age (Sun and Chen, 2016). Before 2020, online education was gradually progressing in a relatively low phase compared to the digitalisation of the other public and business sectors (Olszewska, 2020). In 2020, the COVID-19 pandemic resulted in a paradigm shift in the higher education sector (Sangster et al., 2020). Traditional face-to-face academic delivery was replaced by distance education through online platforms. To provide uninterrupted services during social isolation and lockdown, universities and teachers had to implement online versions of the courses offered comparatively quickly (Malan, 2020). However, according to related research, there was significant resistance from teachers in the initial phase of the transition (Shambour and Abu-Hashem, 2022), as the process of transition from the traditional classroom to the online setting was a giant leap of the process for them (Ali et al., 2021). Although inevitable, the technological demands of online education were a considerable burden on teachers (Kandri, 2020). Contemporary research shows that this unexpected shift in education affected teaching and learning as a whole (Shambour and Abu-Hashem, 2022).

Provided that the online setting was the only option for uninterrupted provision of services under the circumstances, irrespective of how technologically savvy, teachers were compelled to use online platforms and re-construct the courses accordingly on a terse notice. Previous studies have also shown that the teacher's resistance to technology adoption and the limitations in supporting online education are mainly due to the level of capacity, literacy, and technology readiness among teachers (Budur et al., 2021; Krull and Mallinson, 2013). Therefore, it is essential to understand the teaching and learning landscape in online forms. Teachers' adoption of online education is investigated as to how teachers address the rapid transition to online settings. Furthermore, this paper aims to understand how teachers address the barriers to technology adaptation and online teaching, thereby bringing insights for better and more effective higher education in the digital age. Moreover, this study systematically explores teachers' perceptions of online education to identify the challenges and opportunities of teaching and learning online, thereby instrumenting a mechanism to build the capacity suitable for online teaching. The following research questions are formulated to understand the context.

- What challenges and opportunities do teachers perceive when offering courses in online settings, considering the practices during the pandemic period?
- How can these teaching experiences during the pandemic period be utilised for effective and efficient technology-enhanced learning?

Whilst the above illustrated an overview of the study, the rest of the paper discusses the online accounting education background and methodological aspects, followed by the analysis, discussion, and conclusion.

2. Background

Academics emphasise the need for increased education quality in general (Petrinko, 2019). Subject areas such as accounting demand high-quality formal education qualifications to serve the industry (Richards et al., 2019). However, the quality of online education is yet to be recognised compared to its counterpart of on-campus education programmes, specifically in the business sector. E.g., the business sector is reluctant to hire graduates from pure online accounting programs, frequently highlighting quality issues due to limitations pertaining to monitored activities and examinations in a controlled environment in the online education system (Grossman and Johnson, 2016). Typically, students' active involvement in learning helps to improve the quality of education (Degtjarjova et al., 2018). The learning engagement in the online platform depends on the nature of the course design and the technology used (Arbaugh et al., 2009). According to some studies, in the field of accounting, teachers face difficulties in explaining concepts via online platforms due to the subject's complexity, technicality, and practical nature (Sangster et al., 2020; Grabinski et al., 2020). On the contrary, some educators favour online accounting education, understanding the range of learning opportunities and the flexibility in the course delivery (Love and Fry, 2006; Tabatabaeian et al., 2021; Grabinski et al., 2020). However, teachers' motivation and involvement in the innovative design and delivery of online courses is a crucial prerequisite for quality enhancement in accounting education (Love and Fry, 2006; Reyneke and Shuttleworth, 2018). Therefore, universities and academics must pay extra attention to understand the technology need, the use, and blending of technology to the pedagogy when delivering courses. This paper seeks to investigate the different experiences faced by accounting teachers during the transition. Further, the findings are directed to establish actionable strategies in the development of online education, understanding the teacher's actual literacy gap.

3. Methodology

3.1 Theoretical background

In distance education, the interplay between environment, teacher, and the learner will get interrupted due to separation, defined as the Transactional Distance (TD). The psychological and communication gap created due to physical separation is a barrier in achieving the desired level of learning outcomes in distance education (Moore, 1991; Roach and Attardi, 2021). Accordingly, TD leads to a knowledge gap and a space for misunderstandings. They are interpreted under three dimensions, structure, dialogue, and learner autonomy. It is found that proper management of the above dimensions can support student satisfaction, where university requires well-formulated approaches in designing and operating the structure, dialogue, and learner autonomy (Mbwesa, 2014). The extent to which the TD is managed is decided by the individual learner's behaviour and expectations (Moore 1991). However, for this study, the dimensions of the TD and the guidelines are considered as the theoretical base since they provide a foundational mechanism to understand the teachers' experiences related to the transition of education from a traditional classroom to online during the COVID-19 pandemic.

3.2 Research strategy, participants and data collection

Case study strategy is followed in this research since a case study is a qualitative inquiry that facilitates a more in-depth understanding of a complicated context that cannot be described with a limited set of variables (Cassell and Symon, 2004; Harrison et al., 2017). No fixed determinants explain the teacher's thinking about the new teaching paradigm. A case study enables contextualising and limiting the problem space allowing an overall understanding of what teachers in the specific case experience during the transition. The accounting and finance department in a semi-government higher education institute in Sri Lanka is used as the case. Data collection is conducted with all eight (8) teachers in the department (Table 01). Semi-structured interviews were used to collect the data and the interview guide was developed based on the TD theory using the dimensions of dialogue, structure, self-autonomy (Moore 1991) and other related literature (Huang et al., 2015; Zhang, 2003).

Table 1: Details of the participants

Person	Age	Gender	Designation	Years of Experience
DS	27	Female	Lecturer Probationary	3
CV	32	Female	Senior Lecturer	7
GG	27	Male	Lecturer Probationary	2
MD	31	Female	Senior Lecturer	5

Person	Age	Gender	Designation	Years of Experience
DE	28	Female	Lecturer Probationary	3
DK	32	Male	Senior Lecturer	6
DB	28	Female	Lecturer Probationary	3
TW	31	Female	Senior Lecturer	6

4. Analysis and discussion

Teachers' experiences in the transition from traditional to online teaching are explored under themes, "students' behaviour in the online setting", "teachers' approach to handling online setting", "institutional support", and "perceived effectiveness of the online setting". These themes elaborate the experiences of teachers, including how they perceived the effectiveness of their work setting.

Students' behaviour in the online setting

Teachers perceived that communication with students is a key to learning. They have introduced online chat facilities for this purpose. However, the teachers believe that the online classes were less interactive, and students were neither engaging in discussions nor responding "enough" to teachers. The online chat option has become the main mode of interaction. The simplicity of the function and ease of use is considered the reason for its popularity, but teachers were not fully satisfied with the communications via chat. Teachers think the interactions should be beyond simply sending a message in the chatbox and extend to a broader aspect of interaction that creates dialogue. Teachers also wished that the student be physically visible (through a webcam) to increase the possibility of understanding if the students' do not grasp the lecture or when they need to clarify doubts, even if the majority of students were listening to the lectures silently.

> *"Those who didn't communicate in physical classes started communicating via chat in online lectures… I like the physical interaction of the students; I get satisfied when I see students are engaging, talking, sharing, and their facial expressions during the class, so that is lost in the online class, they just send a simple message.. when we don't see the students in a physical environment how they react, we missed that" [DE]*

Teachers believe that they have more room to control the learning environment and support students when they are physically present in the classroom. This convensional monitoring of students in the traditional class is a motivating factor for students to interact and engage in learning. Limitation of the view of the classroom in the online setting, since the students (especially in large classes) are not visible to the teacher, seems daunting to the teachers.

> *"Even though I point out a student in online, I can't get the answer. They don't speak. I can't force the student, as I don't have any control, but in the physical setting I'm in front of the student, they attempt to answer anyhow, whether they know or don't know" [CV]*

Accordingly, the teacher experienced an uncontrollable situation compared to the in-class counterpart. The momentum the teacher tries to create to engage students in discussion and interactions seems to have failed in this situation. Teachers typically value student engagement in online classes as equally as in their physical classroom.

> *"Communication is not just verbal or through chat messages; even in the classroom, the communication happens in various ways. That part is crucial for me as an instructor" [TW]*

Students' intensity and enthusiasm for interaction depend on individual characteristics. The teachers noticed reduced self-motivation among many of the students. Teachers believe the students are compelled to switch on the webcam and are reluctant to present themselves in the online class. But some motivated students may not be influenced by the mode; they continue the interaction, irrespective of the platform.

> *"There are a few students ask questions... when you conduct three or four sessions online, you observe the same set of students asking questions every time. What about the rest? we don't know what they're doing" [DK]*

Inconsistencies were observed among different student groups in the case of using the chat functionality. According to the teachers, increased online interactions were observed among the students in their first academic year compared to those in their third academic year. Moreover, third-year students had a transition from the physical classroom to online, while first-year students started their courses in an online form. So, the

third-year student group may likely be comparing the pros and cons of the two settings and were less motivated for interactions.

> *"They enjoy this new technology. So, Students were motivated...first-year students were very enthusiastic at the very beginning... third-year students they are not much enthusiastic... first-year students, started online due to the pandemic in 2021, but third-year students had a shift from physical to online" [TW]*

Teachers believe that social interaction is essential for students, which is limited in the online setting. Therefore, teachers perceive that students who previously had the experience of a very interactive, live, and friendly learning atmosphere has found the online setting as a less interesting counterpart that limits social engagement, which is an essential element of campus life. Peer (Learner-to-learner) communication is another aspect examined under transactional distance. However, teachers did not specify any peer interactions. Although, teachers are not satisfied with the space provided for peer communication during the online class, as they believe it can function through different digital platforms outside the classroom. However, teachers emphasise the need to have a physical setting for smooth learner-to-learner interaction. There is a gap between the teacher's expectation of student interaction and the actual interaction level of the students in online classes. Teachers expect students in an online class to interact similar to the traditional class, considering interaction in a broader spectrum.

In the process of education, interaction is a crucial element (Dewey, 1916). Even online, direct and interpersonal communication affordances are considered one of the features ensuring quality (Kohlmeyer et al., 2011). Furthermore, efficient online interaction methods have been technologically innovated due to the demand for digital technology for communication (Vlachopoulos and Makri, 2019). Yet, barriers to interaction were recognised in online education (Gambashidze, 2021), limiting successful interaction between the teacher and the students. In the traditional classroom, teachers can observe students' engagement via direct interactions with other students, typically walking around the class, understanding facial expressions, and providing personalised support whenever possible. Such strategies are not possible in the online setting due to the physical and psychological distance between the student and the teacher (Sangster et al., 2020). Due to this distance, teachers do not experience satisfactory interaction with students in the expected modes.

Furthermore, teachers assume that students are not enthusiastic to interact, even though the reality is not exactly the same. Interactions are limited to a few exceptionally active students chatting in the discussion forum, while many of the students are passive receivers. It is also a fact that students' personalities and readiness for online education have a significant role in maintaining the best fit between the learning platform and the student (Vlachopoulos and Makri, 2019). However, the online education platform is a comfortable interaction zone for students who do not like to expose themselves (Owston, 1997). In such circumstances, teachers are clueless about student behaviour. Furthermore, students who had experience in the physical classroom understood that they were not given the required level of opportunities in the online platform (Koris et al., 2021). Students' self-motivation to interact can be maximised by closing the gap between the intended interaction from students and the instructional design (Barberà et al., 2014), where the teacher has a more significant role in influencing students' behaviour and providing them opportunities to engage and interact.

Teachers' approach to handling the online setting

When online education became the only alternative to facilitate education during the Covid lockdown, teachers who did not have a prior online teaching experience struggled to adhere to this new situation. A substantial amount of preparation was required to transform the courses and delivery to online setting. Teachers attempted redesigning the course materials, which required additional effort and knowledge.

> *"It requires a certain level of preparation than a physical environment. We had to reprepare the answers in Excel. In a physical class, the calculation is done on the whiteboard. We show the students how the answer is solved. But in accounting modules, we had to prepare the answer beforehand, go to the class and tell them" [DE]*

The teacher perceived that the preparation of additional material and readymade answers to (accounting) questions was a positive change. Since the lectures were recorded and disseminated after the class, teachers were required to design and deliver the lessons carefully. However, at the beginning of the online course preparation, some amendments were made to the study materials without any significant changes to the

content (syllabus), as teachers were constrained to deliver the syllabus approved by the university administration. Presenting accounting calculations without the whiteboard was a major challenge faced by the teachers, currently supported by MS Excel.

> *"I'am teaching accounting modules. We had to redo a lot of study material because we used PowerPoint presentations, with spaces for students to write the calculation with workings, but in the online sessions, it was not easy, like using the whiteboard. Hence, we had to redo a lot of material for calculations and all other workings, which is done in Excel" [TW].*

Teachers do not consider Excel as a perfect solution in teaching accounting due to its inability to show links and formulas. Yet, it was the only tool that served the purpose with immediate effect. Even amidst issues, they continued redesigning materials using excel. They expressed no enthusiasm for seeking new educational technologies and tools for this.

The three primary reasons leading to the low motivation for seeking new tools were:

(1) Time-bound rigid content – Teachers are restricted with a rigorous syllabus to be delivered within a given timeframe, limiting their flexibility. The use of new educational technologies is considered more time-consuming by teachers. Searching for a suitable tool and learning to use it, preparing and executing the action, balancing technical problems in the class, etc., tends to discourage teachers from moving to new tools.

> *"Was concerned in managing time with the calculations and content. So, I did not try new things much" [DB]*

(2) Digital literacy – Without literacy, teachers would not be able to search for new technological tools and use them in the courses appropriately. Most of the teachers have accepted that they are not digitally literate.

(3) Lack of self-motivation – Teachers are not naturally motivated to search for new technological mechanisms to ease online teaching. They are just followers that follow what is currently existing and trained by the institute.

> *"I'm not self-motivated to go for new options" [MD]*

Instead of technological involvement, teachers use different activities such as group discussions and question-based discussions to facilitate students' engagement and interaction. However, those activities are rather unattractive in online setting (especially in accounting) due to its emphasis on calculations.

> *"Rarely I had to use breakout rooms because we are very technical and systematic in teaching Accounting" [MD]*

Presuming numerical calculations as the core of accounting modules, teachers are reluctant to replace them with other activities such as group work, which significantly restricts the use of collaborative activities.

> *"Lot of calculations are there. If we replace those calculations, the main purpose of that module will be gone. It's a specific issue for accounting modules. Accounting concepts can be properly learned only by doing the calculations" [DK]*

According to teachers, the transition of accounting programs from traditional to online is successfully managed due to the abovementioned transformations, although no other data are provided to support the claim. The transition was too quick for them and has been seen as a blind walk without an appropriate base of knowledge and practice (Harasim, 2000). Typically, such a shift in the educational setting requires a massive change to traditional teaching, pressuring pedagogical, cultural and institutional dimensions to adapt to the new teaching and learning (Howell et al., 2004). Even though there is no systematic introduction of technology to education, teachers were aware of the need to apply different techniques in online education. In principle, digital technologies should be methodologically integrated into online education's formal and informal learning environments (Khalid et al., 2015). Teachers' digital literacy and involvement in technology are essential to transmit the maximum benefits of technology-oriented learning to students (Keengwe and Onchwari, 2009), which teachers do not progressively follow in this online context.

Institutional support

Teachers observed the institute's initiatives to set up an online education platform from scratch. They were very positive about the support they received from the institution in operating in the online setting.

> *"We had to quickly move to this online platform. So, without the support from the institution, we couldn't do that" [CV]*

Institutional support is explained in two ways.

(1) Technical facilitation – Teachers believe that the institutional intervention and support were significant, providing necessary software and training for the teachers. Furthermore, the training aimed at familiarising different technological features in the online platform, such as online submission of activities and assignments, recording of lectures, sharing files among peers etc.

> *"We are given the required software and the support from IT; we got software and LMS training ……How to manage, how to conduct lectures, we were property advised and trained" [GG]*

While focusing on software, no considerable attention was given to hardware establishments. Teachers believe that the institution is entirely responsible for providing hardware solutions.

> *"Sometimes, we must wait at least 10 minutes to start the machine and log into our zoom or Ms Teams account…. Machines are not technically good enough to support online lectures because of viruses and hardware issues... Not enough internet provided" [MD]*

(2) Supervision – The institution strictly monitors online delivery, however, in certain instances, teachers are perceived as an extra burden and a stress creator.

> *"It was monitored, and that could also have been a stressful factor" [DB]*

Conversely, monitoring is regarded as a motivator and quality assurance technique that encourages the teachers to reach the best quality online learning setup.

> *"We are being overlooked. So, we knew that we had to do a good job. So that was supportive" [GG]*

However, teachers were not satisfied with the institutional support in enhancing the learning environment and conducting online teacher training programmes.

> *"We didn't have special training on online teaching" [KT]*

The belief of the need for control of the class for better engagement and learning left the teachers with doubts that losing control over students may have resulted in a lack of engagement, attendance issues and unpleasant situations. Still, the institution has not made any policy involvement in managing the situation. Teachers had to take action to control the problems, which resulted in inconsistencies in the decisions made by different teachers.

> *"Students misbehave; there were certain incidences I had to go through... I had to disable the videos because sometimes students try to misbehave you by using these tools" [SW]*

Institution laid only the technical foundation, and the responsibilities of operating the online education were handed over to the teachers, which has become an additional burden for them. Institutional support is essential for teachers to be at the forefront during the online transition (Kibaru, 2018). IT infrastructure is a basic requirement in online delivery (Olszewska, 2020). The institute must consider both software and hardware establishments to ensure smooth delivery. Supervision enables the institution to monitor the use of facilities, expecting positive changes in employees' job performances (Rubel and Kee, 2013). However, supervision should be managed wisely to balance the positive and the negative impacts on employee performance. Successful face-to-face delivery strategies proved ineffective in the online setting (Ali et al., 2021). Universities lack pedagogical training for online classes. They focus more on the training of using IT tools (Phan and Dang, 2017), accentuating the teachers' emerging need for pedagogical involvement from the institution, besides IT facilitation and supervision. As teachers are not self-motivated to activate the change, the responsibility for teachers' professional development should be considered as a duty of the institution.

Perceived effectiveness of the online setting

Even though teachers are conversant about the required change in the system, they just replaced the platform, primarily upon the request from the institute, intending to continue education during the pandemic.

> *"We try to do classroom teaching online, which is ineffective; we just changed the mode" [TW]*

The distance limits the teacher's control over the class, students can stay behind the camera, and the activities are not monitored, resulting in easy distraction, low interaction, and low student engagement. Therefore,

teachers are doubtful about the effectiveness of online education. Due to the absence of students' frequent reactions, online teaching is experienced as a one-way delivery, even though considerable efforts are made to force students to interact. In contrast, in delivering the content, teachers are required to maintain the technology and pay extra attention to personal appearance and voice. In fulfilling all these concerns, teachers seem to be more exhausted, which is not experienced in the traditional classroom.

> *"During Online, it takes a lot of time to teach and make students understand. It is hectic because we just look at this screen and keep talking; no student reactions are observed. We must make sure lots of things are in place in the online delivery... Otherwise, you cannot do the lecture properly and cannot concentrate on teaching... It is hard, and it consumes a lot of energy" [GG]*

Teachers are not in favour of the timetables with back-to-back lectures. They perceive the arrangement of the modules (lectures) may negatively influence the effectiveness of online delivery and to dampen the intensity of the student's engagement and interaction.

> *"Students being in an online environment maybe 6 hours daily, listening to different subjects, one after the other, I don't think their attention level and engagement levels are high for a long time. Gradually their motivation is dropped" [DE]*

Contrary to the physical classroom, the availability of recordings is an added advantage of an online setting, yet teachers are doubtful whether students are privileged by this option. Recordings are recognised as an excuse used by students not to attend lectures.

> *"I'm not sure whether they are going through the recording.. they don't even participate in the lecture due to recording" [CV]*

Technical failures, language barriers, and different knowledge absorption levels of the students are considered facts that challenge the effectiveness of online delivery, which the teachers believe that can be effectively manageable in the traditional classroom. The traditional classroom is a self-oriented setup that enables students to work independently. On the other hand, in an online setting, students can skip a class or activity or share the answers to exams with friends easily. Teachers emphasise the need for students' involvement in activities and solving accounting problems to ensure effective teaching and learning, which cannot be successfully performed online. Therefore, teachers experience a challenge in confirming academic integrity, which causes quality issues among students and degrades the overall quality of online education.

> *"One or two people do the activity, and then they share the answers" [DS]*

Teachers prefer a traditional classroom setup, emphasising the limitations and ineffectiveness of online education. To ensure effective online education, revisions to the plans, programmes and processes in line with the virtual platform are prerequisites (Sangster et al., 2020). A range of drawbacks was pointed out by the teachers that could be relevant for the effectiveness of online education.

- Disconnection with students leads to a loss of control; doubtful on student's engagement (Ahshan, 2021; Ali et al., 2021).
- Effective use of lecture recording (Muthuprasad et al., 2021), yet teachers perceive that recording does not encourage students' live engagement.
- Open space for students to share their work, therefore issues in academic integrity (Kennedy et al., 2000).
- The risk of students are achieving desired learning outcomes due to lack of student's engagement.
- Hectic timetable arrangements; there should be considerable breaks between long-duration classes and between two different modules to ensure increased productivity (Muthuprasad et al., 2021).

These challenges identified by the teachers must be well addressed and mitigated to continue online education. Although the advantages of online education have been discussed widely and extensively in the past research, implementing online education 1) in a short time, 2) for subjects with many activities and examinations to practice and test the concepts, 3) with teachers who may have not necessary experience in online teaching, 4) with curricula that have not followed the pedagogy suits online education, and, 5) in institutions that do not have tailored technology infrastructure and policies for online education, is something that has to be carefully and thoroughly planned and executed. The abovementioned limitations perceived by teachers only focus on the teacher's concerns, but additional limitations perceived by the other stakeholders, such as students and administration should be concerned

5. Conclusion

According to the findings of this study, teachers do not recommend online forms as a permanent educational solution due to the concerns related to students' behaviour and teaching approaches used in the online setting. Effective teaching strategies are lacking in the current educational setting, as teachers continue to use the same teaching mechanisms only by replacing the platform. They were reluctant to step away from the traditional teaching, highlighting time constraints, lack of self-motivation and digital literacy. Teachers do not perceive online education as effective mainly due to the mismatch between the teaching approach and the platform. However, teachers demonstrate a greater awareness of the necessary change, yet no teacher showed a considerable self-motivation to use educational technologies to change the teaching approach suitable for online education. Maintaining the connectivity with the students online and implementing structural changes to the course targeting active learning engagement is challenging, as teachers are passive in applying digital technologies in teaching practices. Teachers are required to be digitally literate to ensure effective and efficient technology-enhanced learning. However, teachers expect institutional engagement in establishing adequate infrastructure, efficient support mechanisms in terms of policy, and pedagogical underpinning, to manage students and change the teacher's approaches to ensure effective and efficient technology-enhanced learning in the online setting. Teachers' digital literacy levels and the institutional role in nurturing teachers' digital literacy can be further investigated in future research to ensure effective and efficient technology-enhanced learning.

References

Ahshan R. (2021) A Framework of Implementing Strategies for Active Student Engagement in Remote/Online Teaching and Learning during the COVID-19 Pandemic. *Educ. Sci.*: 24.

Ali I, Narayan AK and Sharma U. (2021) Adapting to COVID-19 disruptions: student engagement in online learning of accounting. *Accounting Research Journal* 34: 261-269.

Arbaugh JB, Godfrey MR, Johnson M, et al. (2009) Research in online and blended learning in the business disciplines: Key findings and possible future directions. *The Internet and Higher Education* 12: 71-87.

Barberà E, Layne L and Gunawardena CN. (2014) Designing online interaction to address disciplinary competencies: A cross-country comparison of faculty perspectives. *The International Review of Research in Open and Distributed Learning* 15.

Budur T, Demir A and Cura F. (2021) University Readiness to Online Education during Covid-19 Pandemic. *International Journal of Social Sciences & Educational Studies* 8.

Cassell C and Symon G. (2004) *Essential Guide to Qualitative Methods in Organizational Research*: SAGE.

Degtjarjova I, Lapina I, Freidenfelds D, et al. (2018) Student as stakeholder: "voice of customer" in higher education quality development. *Marketing and Management of Innovations*: 388-398.

Dewey J. (1916) Democracy in Education. *THE ELEMENTARY SCHOOL TEACHER*: 12.

Gambashidze N. (2021) Transactional Distance Theory and Compulsory Switching to Remote Teaching due to pandemic in Georgia. *Condiții pedagogice de optimizare a învățării în post criză pandemică prin prisma dezvoltării gândirii științifice.* "Ion Creanga" State Pedagogical University, 74-84.

Grabinski K, Kedzior M, Krasodomska J, et al. (2020) Embedding E-Learning in Accounting Modules: The Educators' Perspective. *Education Sciences* 10: 97.

Grossman AM and Johnson LR. (2016) Employer perceptions of online accounting degrees. *Issues in Accounting Education* 31: 91-109.

Harasim L. (2000) Shift happens: online education as a new paradigm in learning. *The Internet and Higher Education* 3: 41-61.

Harrison H, Birks M, Franklin R, et al. (2017) Case study research: Foundations and methodological orientations. *Forum qualitative Sozialforschung/Forum: qualitative social research.* 1-17.

Howell SL, Saba F, Lindsay NK, et al. (2004) Seven strategies for enabling faculty success in distance education. *The Internet and Higher Education* 7: 33-49.

Huang X, Chandra A, DePaolo C, et al. (2015) Measuring transactional distance in web-based learning environments: an initial instrument development. *Open Learning: The Journal of Open, Distance and e-Learning* 30: 106-126.

Kandri S-E. (2020) How COVID-19 is driving a long-overdue revolution in education. *World Economic Forumn.*

Keengwe J and Onchwari G. (2009) Technology and Early Childhood Education: A Technology Integration Professional Development Model for Practicing Teachers. *Early Childhood Education Journal* 37: 209-218.

Kennedy K, Nowak S, Raghuraman R, et al. (2000) Academic Dishonesty and Distance Learning: Student and Faculty Views. *College Student Journal* 34: 309.

Khalid S, Sl T, Parveen M, et al. (2015) A systematic review and meta-analysis of teachers' development of digital literacy. 10.

Kibaru F. (2018) Supporting Faculty to Face Challenges in Design and Delivery of Quality Courses in Virtual Learning Environments. *Turkish Online Journal of Distance Education*: 176-197.

Kohlmeyer JM, Seese LP and Sincich T. (2011) Online Versus Traditional Accounting Degrees: Perceptions of Public Accounting Professionals. In: Catanach AH and Feldmann D (eds) *Advances in Accounting Education.* Emerald Group Publishing Limited, 139-165.

Koris R, Mato-Díaz FJ and Hernández-Nanclares N. (2021) From real to virtual mobility: Erasmus students' transition to online learning amid the COVID-19 crisis. *European Educational Research Journal* 20: 463-478.

Krull G and Mallinson B. (2013) BUILDING ACADEMIC STAFF CAPACITY TO SUPPORT ONLINE LEARNING IN DEVELOPING COUNTRIES. *Online Learning* 17.

Love N and Fry N. (2006) Accounting students' perceptions of a virtual learning environment: Springboard or safety net? *Accounting Education* 15: 151-166.

Malan M. (2020) Engaging students in a fully online accounting degree: an action research study. *Accounting Education* 29: 321-339.

Mbwesa JK. (2014) Transactional Distance as a Predictor of Perceived Learner Satisfaction in Distance Learning Courses: A Case Study of Bachelor of Education Arts Program, University of Nairobi, Kenya. *Journal of Education and Training Studies* 2: 176-188.

Moore MG. (1991) Editorial: Distance education theory. *American Journal of Distance Education* 5: 1-6.

Muthuprasad T, Aiswarya S, Aditya KS, et al. (2021) Students' perception and preference for online education in India during COVID -19 pandemic. *Social Sciences & Humanities Open* 3: 100101.

Olszewska K. (2020) The effectiveness of online learning in the era of the SARS-CoV-2 pandemic on the example of students of Polish universities. 14.

Owston RD. (1997) R ESEARCH NEWS— AND COMMENT-C The World Wide Web: A Technology to Enhance Teaching and Learning?

Petrinko E. (2019) Teachers' Perspective on Wise Education. *Journal of Teacher Education for Sustainability* 21: 67-75.

Reyneke Y and Shuttleworth CC. (2018) Accounting Education in an open distance learning environment: Case studies for pervasive skills enhancement. *Turkish Online Journal of Distance Education-TOJDE* 19: 1-16.

Richards R, Stevens R, Silver L, et al. (2019) Overcoming employer perceptions of online accounting education with knowledge. *Administrative Issues Journal Education Practice and Research* 8.

Roach VA and Attardi SM. (2021) Twelve tips for applying Moore's Theory of Transactional Distance to optimise online teaching. *Medical Teacher*: 1-7.

Rubel M and Kee D. (2013) Perceived Support and Employee Performance: The Mediating Role of Employee Engagement. *Life Science Journal* 10.

Sangster A, Stoner G and Flood B. (2020) Insights into accounting education in a COVID-19 world. *Accounting Education* 29: 431-562.

Shambour MKY and Abu-Hashem MA. (2022) Analysing lecturers' perceptions on traditional vs. distance learning: A conceptual study of emergency transferring to distance learning during COVID-19 pandemic. *Education and Information Technologies* 27: 3225-3245.

Sun A and Chen X. (2016) Online education and its effective practice: A research review. *Journal of Information Technology Education* 15.

Tabatabaeian MS, Mashayekh S and Rahmanian Koushkaki A. (2021) Online Accounting Education: Opportunities and Innovations. *Iranian Journal of Accounting, Auditing and Finance* 5: 1-20.

Vlachopoulos D and Makri A. (2019) Online communication and interaction in distance higher education: A framework study of good practice. *International Review of Education* 65: 605-632.

Zhang A. (2003) Transactional distance in Web-based college learning environments: Toward measurement and theory construction. Ann Arbor: Virginia Commonwealth University, 234.

Analysing Reflections of Academics Through the Framework of Well-Being

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Abstract: Although South Africa is a developing economy, the majority of its people live in poverty, exacerbated by load shedding, which leads to issues relating to connectivity and access to technology. This affects the teaching and learning modes of academics in the higher education sector. Academics have previously, and during the pandemic, shown efficiency and effectiveness in moving to various modalities as and when expected. The same was displayed when they were asked to prepare for online or remote teaching platforms that some of them had previously used. Consequently, in academia, this shift resulted in an escalation of the adoption of novel pedagogies accompanied by increased stress and anxiety-related illnesses. In this paper, the researcher reported on the findings of a survey conducted via focus group interviews with departments at a university of technology in South Africa to analyse its impact on their work and/or work-life balance. Ryff's (1995) theory of well-being was used to analyse the qualitative data. The findings conclude that the lockdown and subsequent move to online teaching has had a negative impact on the well-being of academics. Significant outcomes of online teaching, along with positive outlooks, caring relationships, and support between management and colleagues, have been reported.

Keywords: COVID-19, academic well-being, higher education, online teaching, academic reflections

1. Introduction

At the onset of the pandemic in March 2020, while the health risks of the pandemic increased rapidly, other constraints like connectivity, bandwidth and technology played havoc with the new mode of online teaching. The failed grid in South Africa, leading to power outages for a minimum of two hours or longer in the rural areas has become a constant hindrance, affecting online teaching. The academics who had just moved to online modalities, had to now switch to a low-tech mode of teaching. This meant that the lectures happen asynchronously, which has its own resource implications as an asynchronous mode is generally more cumbersome and time-consuming when it comes to the preparation of content than delivery. All this brought in health issues around stress, anxiety, gut health, and mental health which became a topic for investigation (Mbunge 2020). The literature collection highlights the impact of the pandemic on issues around the mental health of front-line workers globally (De Kock, Latham, and Leslie 2021; Babore 2020; Cai 2020). Sahu (2020) introduces the challenges that academics face during a pandemic, such as moving to teaching online, travel restrictions preventing research and conference attendance, the challenge of assessing students online, and mental health issues such as depression and anxiety arising from increased stress and workloads, isolation, and the uncertain future academics now face as universities turn increasingly towards technology for cost-effective teaching. Such challenges, framed in the wider sphere of workplace readjustment during COVID-19 as a state of "pandemia", have been studied in a variety of international contexts; for example, in Australia (McGaughey et al. 2021), and in Ireland and the UK (Watermeyer et al. 2021). Not only this, but academics also had to worry about the health and mental well-being of their families, and their students' concerns and well-being. Keeping these contexts in mind, the researcher invited colleagues across the institution to participate in focus group interviews to highlight the challenges and impact of the pandemic on their well-being.

2. Literature

2.1 Exploring recent studies in the domain

While putting this paper together the inadequacy of peer-reviewed publications that focused on the impact of the pandemic on academic well-being became evident. A search carried out using PUBMED, EBSCOHOST, and ERIC found no articles that dealt specifically with this topic in the South African context. A local South African journal published one article that focused on universities globally, not specifically on South African universities (Hardman et al., 2022). Very few studies researched the impact of COVID-19 on gender and well-being from a different country's perspective. The SciOPS (Scientist Opinion Panel Survey) article could be the closest as it addresses similar issues (Jung 2020). The study found that COVID-19 had negatively impacted academics' ability to concentrate and increased anxiety around contracting the virus and the effects of unanticipated childcare responsibilities during home schooling.

The paper, however, prominently focuses on the gender dynamics that COVID-19 had on academics, especially female academics, when it comes to experiencing feelings of anxiety or difficulties in concentration and having parental responsibilities. The gendered dimension of the division of labour is well established in the literature in general (Miller 2020; Ward and Wolf-Wendel 2016; Guy and Arthur 2020) and specifically concerning the impact of COVID-19 on academics (Miller 2020; Yildirim and Eslen-Ziya 2021; Burzynska and Contreras 2020). Female academics who are mothers experienced a higher level of work at home because of the added responsibility of home-schooling and childcare, and consequently were more likely to report feelings of being tired or overwhelmed by the amount of work they were facing with online teaching (Miller 2020; Jessen and Waights 2020; Lutter and Schröder 2020; Andersen et al. 2020). The research is specifically focused on one institution which is the only University of Technology in the Western Cape Province of South Africa and the biggest university in the province with over 30000 students.

2.2 Ryff's model of well-being as a perspective

Ryff's (1995) model of well-being is presented in this article. It has six dimensions of psychological well-being, viz., autonomy, positive relationships, personal growth, environmental mastery, self-acceptance and purpose in life.

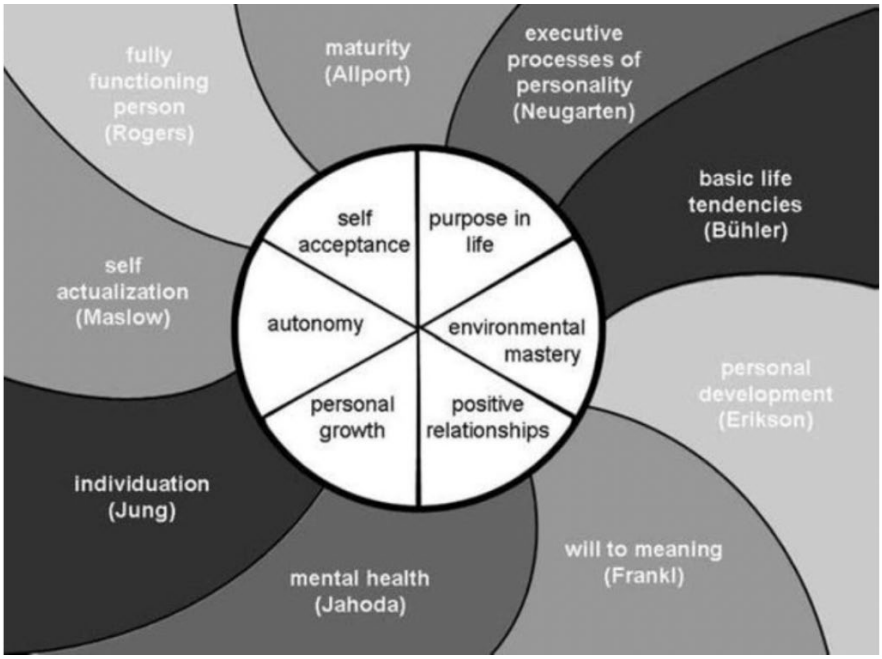

Figure 1: Ryff's model of well-being in adult life

Empirical research carried out by Ryff has established the validity of these dimensions (1995; 2014). On unpacking these dimensions, one can understand that personal growth at an individual level means having a sense that one can realise their potential. Environmental mastery refers to a sense of mastery over the external environment. For example, environmental mastery as a dimension of well-being in South Africa would be extreme poverty faced by much of the population, mitigating against a sense of environmental mastery, calling for serious systemic change. Positive relationships refer to an individual's ability to maintain and construct healthy, positive relationships with other people in their social situations. Self-acceptance refers to an individual's positive opinion of themselves. However, it also relates to being able to identify and acknowledge both strengths and weaknesses. One can navigate the world successfully on their own initiative and with autonomy. Finally, one's purpose in life is to have a sense of direction and aims and objectives for living, which is often derived from the career we choose to pursue. Well-being, for Ryff and other researchers, requires a level of autonomy and control over one's life and environment that is absent in spaces where poverty is endemic and unemployment amongst youths is over 50 per cent. While many people may feel alienated from their environment and lack autonomy over their own lives due to poverty, there is still the notion that positive relationships exist and can be used to develop one's well-being. It is against these dimensions that the current research paper seeks to understand the impact COVID-19 had on academic well-being at a university of technology in a developing country like South Africa.

3. Methodology

In this paper, the author analyses the impact of the pandemic on the academic's health and well-being at a university of technology. The target population were academics from a university of technology in Cape Town, Western Cape province, South Africa. The survey was done within departments via focus group interviews to analyse and learn more about how teaching and learning impacts on their work and work-life balance. There are six faculties within the institution and the focus group interview invite was extended to all the departments in the institution. However due to modality of online teaching and the work commitments involved, the author couldn't get enough buy-in from all of the departments. Some who agreed and committed initially for the interview denied closer to the time due to work and family commitments even though the interviews were conducted virtually. The research therefore involved four faculties, involving 10 departments and approximately 30 participants. The participants of this survey were chosen from a convenience sample; this research paper is hence not intended to establish a wider population, but to pinpoint transitions that could be explored in future research. The department heads along with their staff were sent an invite to participate in the focus group interview. If the staff couldn't attend ,then a special request was sent if the department teaching and learning coordinator or the curriculum officer could join with their department heads to get an overview of their department coping during COVID-19. Interviews of between 30 to 60 minutes were facilitated by the researcher. The focus group interviews were carried out virtually in the respective departments, which was based on their availability.

Interview questions were designed to gather insights into the perspectives on departmental buy-in, particularly on the impact on academic staff and their well-being, and the adoption of e-Learning platforms. Following this phase, interviews were transcribed and later analysed independently by the researcher. As a flexible method, it could impart a rich and nuanced account of complex data. The respondents differ widely in terms of age, digital literacy skills, and confidence in using technology or undergoing technology training, and accordingly, their impacts will differ from one another. However, there were converging themes, such as collaboration, reflection, and empathy, all elements of a design thinking mindset. Ethical clearance was sought through appropriate institutional channels. For purposes of confidentiality, participant details were kept anonymous.

The demographics show 39% of females, 60% of males, and the remaining 1% preferred not to state their gender. Most of them live with at least one family member and possess the academic status of lecturers, associate professors, and heads of departments. Fifty-four percent of the participants have doctoral degrees and the remaining are either doctoral students or have Master's qualifications.

4. Findings

The focus group interview included open-ended questions. These open-ended questions were analysed using the categories outlined by Ryff's (1995) framework. The responses from the academics were first transcribed using a transcriber and were put together in a document format and coding was done to put them under themes that suit best to Ryff's framework. Towards the end of the coding process there were few outliers which were not included as they involved talks like greeting each other at the beginning and end, acknowledging each other virtually and checking on the timeline due to work commitments. The findings mentioned below are in the form of responses as was stated exactly by the participants, no change in language and grammar has been made to avoid bias to the research work. The statements are kept in italics for ease of readability to the audience. As the interviews were slotted close to an hour there were a lot of discussions involving both parties, however for the purpose of the page limitation the led the author to include most of the statements and not all of them.

Theme 1: Autonomy

Ryff's framework speaks about autonomy, which refers to one's belief that one can navigate the world using one's own initiative and regulate one's behaviour to be who one is, rather than submitting to a societal picture of who one should be. Academics have expressed their concerns about the lack of time for research and personal growth and the reduced autonomy over teaching.

> *"What's happened in terms of my workload now, it's as I said, what's happened. The HOD's basically increased my workload from this year onwards. So, as I said, normally I would have two. I would have had the full first and second-year groups, which would have taken me up to over 500 students, you know. = But you know, it's almost something I want to do, like research my practices*

> *and everything. You know, I can't get enough time and it's like no one cares. And I have to make myself available if anyone needs support."*

The participants expressed concern that teaching and support have been extensive and that there is very little time for research. Being passionate about the work they do, missing out on publishing their own practices does impact them. Publishing research work is vital and central to an academic's growth of a sense of autonomy, which has now been impacted by the pandemic.

> *"So that is really because for us it's about departments now, it's we have a very clear mandate now from the DVC, you know, we need to start focussing on this pocket of excellence and make sure that this is more welcoming [inaudible] and we're still a very small team, so we're trying to understand how best we can impact."*

What is evident from the above two participants is the fact that one of them sees growth and an opportunity to grab on and create excellence through it, and the other is concerned about how it has affected her personally and her personal growth.

Theme 2: Environmental mastery

In a country poverty-stricken like South Africa, where there is inequality and , trying to control one's environment is gravely diminished, and the pandemic has further brought it into the centre of attention. The pandemic and the drive towards rapid digitalisation havemade academics move more towards managerial activities, which is not the environment they flourish in and hence feel alienated. They no longer have control and at all times wait for directives from the management. The statements below say what the academics have to say about the management and the steps taken by them recently.

> *"It's two-way because if there's no interest by management or for anything part-time, then you know, or in a more flexible way and then there are these pressures from the outside. I mean, there is lack of space and lack of equipment and lack of infrastructure and all of that, I think from the institution, because if you say that yes, the departments can have guidelines which are specific to their needs, but from the institution, the reason being is that at the ground, Dr, at the element where people we are teaching, if you come up with something and say, "This should be for a department." And then people are saying, "Ja, but other departments are not doing it" or, "This is not a mandate from the institution so I'm not going to do it. It's not compelled by the institution." So from there, if something that the DVC says, "This is what we need to do" or "This is what we need all of us to embrace, Deans, Teaching and Learning Coordinators, HOD" you enforce on the ground [indistinct]. And then I think that can work and then of course departments can have context-specific guidelines but from up there, the strategy needs to filter down."*

> *"There were other challenges for me, not sure if the others had the same like me. The schools allowed kids to study online, but what about the follow-ups, the homework, the distraction and noise from their sessions. If you had a pre-schooler, then that added to the glory. Amongst, all this one cannot perform even if you lock your doors, and by the time it's quiet at night you are already tired. There were many months, not days where I had to stay awake till [the] early hours of the morning to make a quality contribution to my work. And the constant fear that no one should fall sick, that we eat the right food and supplements to stay healthy and fit."*

There could be many reasons behind this thought; the institution undergoing financial constraints, the closing down of departments and retrenchments among others. From such perspectives, one loses mastery over the academic environment and feels disempowered by the managerial roles that have accumulated, which could be detrimental to academic well-being. Also, at a personal level, being a breadwinner as well as a parent comes with its own challenges of managing the workspace and personal space. The environment was not always conducive at home, where one could calmly focus on work and at the same time worry about chores, homework, health and the well-being of the family.

Theme 3: Purpose in life

Since moving from face-to-face teaching to remote emergency teaching, more emphasis is placed on teaching than on research. This has instigated an acute state of awkwardness and disquiet among participants in respect of their career graph and professional status, where career development, research outputs and competitive

funding as rewards have been taken over by the demands of teaching. There is visible distress and that tidal turn that has been seen in colleagues and academics who have been research-driven throughout their professional careers. As reiterated by an academic below:

> *"And so I'm going to sell them something that[is] already half baked, and I'm going to say, "Okay team, so what can you contribute here? What do you think, is this okay?" You know, be very diplomatic about that and so in that way, get the whole team's buy-in, but I can't go to the team with a blank slate. My intention is to go to the team with something that's there's already a framework, the framework that I had in mind with this 30% being done and rest we put together as a team."*

The need to be concerned about everyone's well-being, be it students or colleagues, calls for an ethics of care at a university that requires that an academic to sacrifice their own needs or purpose of life to meet those of others.

> *"So, that's why I say, there is really not a lot of dialogue happening about anything in the department, never mind eLearning, so ja, it's kind of a frustrating situation to be in – a departmental meeting, to me, plays such a pivotal role in the operations of a department because that's a chance where you get to see your colleagues in a professional environment and discuss issues of importance."*

The COVID-19 pandemic and the need to subsequently move to online teaching have guided academics towards dedicating more time through multiple platforms, in groups and individually, to meeting students' well-being at the expense of their own career path and growth. This is especially so for female academics, who carry a larger burden of care than their male counterparts, impacting their career progression (Viglione 2020; Gabster et al. 2020; Burzynska and Contreras 2020; King and Frederickson 2021; Parlak, Celebi Cakiroglu, and Oksuz Gul 2021).

Theme 4: Positive relationships

While most participants indicated that emergency remote teaching has affected their well-being in many ways, some discerned that they had advanced in more positive, caring relationships with colleagues and students. There were liminal spaces that the participants spoke about, which made them build different relationships during these times:

> *"So I invited these colleagues [and] then I said, "Well, why don't you take the tool and copy it into your subject and then you see how it goes?" Like you know, you do a small something, and two of my colleagues actually did that, and that's how their shift started, and the next thing you know, they were asking me about Collaborate and then they participated in one and then they get their own one, and now they have grown so quickly that it's more a case of I feed questions from them based on their own experiences and then I discover that one of them showed someone else who then had a big Collaborate with his students."*

Another participant spoke about bridging the bond not just as a relationship but also in terms of knowledge.

> *"And the build the bridge. They build a bridge between their knowledge and [an]other person's knowledge. So, it's the bridge that the other person can cross over and for them, their job is not to lead but to build a bridge where the other person can walk on. Whereas, I think their other role is to say I'm the leader, follow me. Whereas, there's a different analogy here where you're saying, if I build bridges, then you can help yourself to where you want to be."*

> *"It was actually pretty good, hey that whole thing, so I just like signed up for it and went on it. It was actually excellent and also helped me in terms of my development because I don't think we're doing that yet. You know we're not really facilitating online at the moment. If I take myself, I am using it to make learning aids available to my students to make it more self-directed from their side."*

It is clear that the sense of collegiality has improved. However, it comes at a price that needs to be paid. The burden of care that academics have towards their students is heavy. Academics face the reality of burnout while working from home without much support. Evidence emerging from publications around the world suggests that it is female academics who are more likely to face burnout due to the increased burden of care they carry (Viglione 2020; Gabster et al. 2020; Burzynska and Contreras 2020; King and Frederickson 2021) and the very real negative impact COVID-19 has had on their ability to publish and engage in scientific research.

Theme 5: Personal growth

The pandemic has given everyone an opportunity to use platforms that would not have otherwise been ventured onto. It has given me a lot of life lessons, lessons with perspectives, and learnings that I will carry with me until I retire.

> *"Yes, so I think it's good to pilot things in small chunks. That's how we started; you know with your encouragement and help, we started with blogging and digital stories and this and that in the full-time programme. Based on that, we could then see that it might work for a part-time programme, but we couldn't make it work inside."*

> *"Ja, the design of it, and it's easier because it is … it's easier the second time around than the first time. Like, setting up this whole, like the foundation [of] Google Classroom, it's really, really hard work. It really – I had to spend a lot of time last year setting it up. This year is so easy. Now, I just click, click, click and this is active and it's now very easy to do, and I don't know how we are going to get over that fear of I have to work harder, but I think, for the younger lecturers, they, anyway, want to do something new."*

> *"I mean, I like the idea of BlackBoard Collaborate or even a Zoom virtual classroom. A virtual chalk and talk but make it much shorter and ja, and then see, like some people were saying that students want to engage. They don't necessarily want to just have theory pushed over to them. They want to somehow interact with each other."*

The feeling after accomplishing something, be it learning a new way of teaching, a quick trick, or even a shortcut to achieve something gives us feelings of satisfaction and happiness, which are small iterative steps towards bigger personal growth. These steps bring us closer to work, give us some life lessons about people we care about and motivate us to work more effectively. Responses from participants highlight the above sentiments. However, learning new skills through platforms like LinkedIn learning has been minimised a lot due to time constraints when it comes to co-learning from colleagues outside the institution through webinars and workshops.

Theme 6: Self-acceptance

Participants emphasised the amount of work that has gone into ensuring that the move to online platforms happens smoothly and benefits students with different needs by making themselves available through various platforms. At the same time, it has shown them a side of themselves that they were perhaps unaware of when it came to working tirelessly to the best of their ability, supporting colleagues and enriching students' lives with available resources. They have steadfastly learnt new tools, implemented them and are willing to share them with colleagues.

> *"And then also at the same time, because I am in a position, this is the nice thing because I know how webinars work, I know how screencasting works, I know how H5P works. I can show them, look these are the things that we can use that's going to make …, I'm going to tell them it's going to make our life easier but I hope they're not going to realise. At first it's going to be more difficult before it gets easier. So that is my plan, whether it's going … so keep your fingers crossed with me, whether it's going to work or not, I don't know, where, we'll see."*

> *"As part of our departmental meeting I had little bits of things about, taking them through, showing them what reports they can draw. At the last meeting, we went through showing them what reporting is available so they themselves can also monitor, you know, what's happening in terms of the student side of things."*

> *"Oh, absolutely you know if I … I looked back the other day and when we started this and I was also doing my thesis at the same time, I don't know how we did it. I was sitting weekend after weekend after weekend recording classes, loading questions and I was teaching two subjects and loading questions and recording sessions etcetera, etcetera. So you know that if I look back and now it's all there and now we can just expand and improve.*

Self-acceptance is evident in the participants' answers above, which are the results of perseverance and a sense of accomplishment. Irrespective of the walk of life they are in, the pandemic has also given them the opportunity to realise their potential and their ability to emerge triumphantly.

5. Discussion and conclusion

This paper analysed how the adaptation to online teaching impacted academics' well-being. The qualitative uncovering foregrounded that the COVID-19 pandemic left a negative impact on academics' well-being, be it work pressure, mental health, or relationships and bonding at the formal level, especially in the areas of autonomy, environmental mastery, and personal growth. Self-acceptance, the purpose of life and positive relationships have nurtured them as professionals. The institution's strong bearing on managerial control has impacted the participants' hold of autonomy. Diminution towards growth in other areas like research has led to anxieties about career growth.

The participants expressed apprehension about losing out on new skills or courses even though progress is being made incrementally, which was possible earlier, which was not only part of personal growth, but also environmental mastery, staying on trend with new advancements in their related industry. Overall, the paper concludes by stating that COVID-19 and the shift to online teaching have negatively affected the participants. Some positive findings in connection with assisting each other included growth in camaraderie, areas of development, positive work relationships and sociability amongst crisis, which resulted in building resilience, and standing up for each other, acted as pillars to well-being (Corbera et al. 2020). This fits in with the African philosophy of ubuntu, towards the development of an ethics of care amongst academics. The onset of the pandemic was beyond anyone's control; however, the researcher hopes that this paper motivates academics to build an ethics of care relationship and design a thinking mindset not only with their colleagues but also with students to face a similar crisis in the future with dignity and support.

The pandemic forced academics to teach courses online, but it was a major change for institutions that were not designed as distance learning units. Other factors like poverty, unemployment, and a failing electricity grid made it worse. The feedback from focus group interviews accentuated the aftermath on academic well-being. All this has also again foregrounded the positive relationships between academics, great learning environments and deeper engagements and interactions with students. Further research is needed to see how effective these relationships and co-learning have been. Will it bring up some firm outcomes on ways to approach another probable crisis or move towards constantly changing industrial revolutions? It is already evident and encouraging to witness academics and students move towards collective well-being and not just individual well-being.

References

Andersen, J. P., M. W. Nielsen, N. L. Simone, R. Lewiss, and R. Jagsi. 2020. "Meta-research: COVID-19 medical papers have fewer women first authors than expected." https://arxiv.org/ftp/arxiv/papers/2005/2005.06.

Babore A. 2020. "Psychological effects of the COVID-2019 pandemic: Perceived stress and coping strategies among healthcare professionals." *Psychiatry Research* 293: 113366.

Burzynska, K. and G. Contreras. 2020. "Gendered effects of school closures during the COVID-19 pandemic." *The Lancet* 395(10242).

Cai, W. 2020. "A cross-sectional study on mental health among health care workers during the outbreak of Corona Virus Disease 2019." *Asian Journal of Psychiatry* 51: 102111.

Corbera, E., I. Anguelovski, J. Honey-Rosés, and L. Ruiz-Mallén. 2020. "Academia in the Time of COVID-19: Towards an Ethics of Care, Planning." *Theory & Practice* 21(2): 191 – 199.

De Kock, J. H., H. A. Latham, and S. J. Leslie. 2021. "A rapid review of the impact of COVID-19 on the mental health of healthcare workers: Implications for supporting psychological well-being." *BMC Public Health* 21.

Gabster, B. P., K. van Daalen, R. Dhatt, and M. Barry. 2020. "Challenges for the female academic during the COVID-19 pandemic." *The Lancet* 395(10242): 1968–1969.

GSMA. 2020. *The mobile economy: Sub-Saharan Africa 2020*. Report.

Guy, B. and B. Arthur. 2020. "Academic motherhood during COVID-19: Navigating our dual roles as educators and mothers." *Gender, Work and Organization* 27(5): 887–899.

Hardman, J., Watermeyer, R., Shankar, K., Ratnadeep Suri, V., Crick, T., Knight, C., McGaughey, F., and Chung, R. 2022. "Does anyone even notice us? COVID-19's impact on academics well-being in a developed country." South African Journal of Higher Education, Volume 36 (1): 1 – 19.

Jessen, J. and S. Waights. 2020. "Effects of COVID-19-day care centre closures on parental time use: Evidence from Germany." https://voxeu.org/article/covid-19-day-care-centre-closures-and-parental-time-use.

Jung, H. 2020. "COVID-19 stay-at-home orders worsen academic scientists' home life: Women experience more difficulties." *SciOPS* May 2020.

King, M. M. and M. E. Frederickson. 2021. "The Pandemic Penalty: The gendered effects of COVID-19 on scientific productivity." *Socius* 7: 23780231211006977.

Lutter, M. and M. Schröder. 2020. "Is there a motherhood penalty in academia? The gendered effect of ren on academic publications in German sociology." *European Sociological Review* 36(3): 442–459.

Mbunge, E. 2020. "Effects of COVID-19 in South African health system and society: An explanatory study." *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* 14(6): 1809–1814.

McGaughey, F., R. Watermeyer, K. Shankar, S. Ratnadeep, C. Knight, T. Crick, J. Hardman, D. Phelan and R. Chung. 2021. "'This can't be the new norm': Academics' perspectives on the COVID-19 crisis for the Australian University Sector." *Higher Education Research & Development*: 1–16.

Miller, K. E. 2020. "The ethics of care and academic motherhood amid COVID-19." *Gender Work Organ* 28: 260–265.

Parlak, S., O. Celebi Cakiroglu, and F. Oksuz Gul. 2021. "Gender roles during COVID-19 pandemic: The experiences of Turkish female academics." *Gender Work Organization* 26: 461–483.

Ryff, C. D. 1995. "Psychological well-being in adult life." *Current Directions in Psychological Science* 4: 99–104.

Ryff, C. D. 2014. "Psychological well-being revisited: Advances in the science and practice of eudaimonia." *Psychotherapy and Psychosomatics* 83(1): 10–28.

Sahu, P. 2020. "Closure of Universities Due to Coronavirus Disease 2019 (COVID-19): Impact on Education and Mental Health of Students and Academic Staff." *Cureus* 12(4): e7541. doi:10.7759/cureus.7541

Viglione, G. 2020. "Are women publishing less during the pandemic? Here's what the data say." *Nature* 581: 365-366.

Ward, K. and L. Wolf-Wendel. 2016. "Academic motherhood: Mid-career perspectives and the ideal worker norm." *New Directions for Higher Education* 2016(176): 11–23.

Watermeyer, R., T. Crick, C. Knight, and J. Goodall. 2021. "COVID-19 and digital disruption in UK universities: Afflictions and affordances of emergency online migration." *Higher Education* 81: 623-641.

Yildir im, T. M. and H. Eslen-Ziya. 2020. "The differential impact of COVID-19 on the work conditions of women and men academics during the lockdown." *Gender Work Organ* 28(S1): 691– 697.

A Conceptual Framework for Integrating TPB With Context-Relevant Variables to Predict e-Learning Success During the Covid -19 Pandemic

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Abstract: The COVID-19 pandemic has necessitated the digitalization of some aspects of our lives including education. However, as we witness a phenomenal rise in the demand for online learning, the decision to migrate to online learning platforms is dependent on the learner's preparedness to embrace it. The objective of this study is to conceptualize a framework that measures the tendency of learners to adopt online learning in an era characterised by so many disruptions. To do this, we adopt document analysis on databases such as SCOPUS, Web of Science, EBSCO and Google Scholar using Boolean search engines; AND, OR, NOT, *, (), ‘’’, +, -, <,>. mainly on current scientific manuscripts through the use of the keywords "e-learning", "theory of planned behaviour", "Covid 19", "distance learning", "environmental factors" and "academic technology adoption". Subsequently, we integrate the theory of planned behaviour with other context-relevant variables as the bases of the study, and conceptualise a framework to predict e-learning success in the covid-19 era. This study contributes to the scientific body of knowledge on e-learning, particularly from the perspective of a forced mass adoption of e-learning occasioned by a global pandemic.

Keywords: e-learning, Covid 19, theory of planned behaviour, education services, intention to adopt online learning

1. Introduction

The outbreak of the Corona virus has disrupted life as we know it across the world. The Covid-19 pandemic has impacted various segments of industry and aspects of human society. Many of the studies have focused on how it affected the educational sector, particularly in terms of how the traditional classroom setting is being disrupted. The number of children, youth and adults who had to drop out of school or the university because of COVID-19, kept rising especially between 2020 and 2021. The closure of schools by governments all around the world was an attempt to contain the global pandemic (Chick et al., 2020; Daniel, 2020; UNESCO, 2020).

While there is no medical solution available or drugs for treatment as of 2022, numerous governments continue to institute measures aimed at minimizing direct human interactions and contact as much as possible. This is necessary to ensure that healthcare systems within societies are not overwhelmed by rising number of infections, which in turn leads to higher mortality figures. Subsequently, traditional education, which relies on physical human interactions, has found itself severely challenged by an existential crisis. This scenario has compelled educational institutions to shut down in many countries around the world. Undoubtedly, it is imperative to consider alternative approaches to the delivery of education. This, with the objective of enabling governments and other stakeholders across the educational sector to continue the delivery of high-quality education to learners. Hence, there is a genuine need to explore education alternatives such as e-learning. This tool has the potential to reduce or eliminate the need for physical interactions to the barest minimum, a desired outcome in challenging times like this.

It is pertinent to state that e-learning as a method of delivery of education has its own peculiarities and unique challenges. Further, considering that widescale adoption of e-learning as a result of the Covid 19 pandemic is unprecedented, this makes it necessary for a scientific inquiry into the efficacy of such alternative approaches. Particularly, the need to investigate the efficacy and success of e-learning in terms of factors such as: cost implications for the learners, availability of conducive home environment learning environments and its impact on effectiveness of e-learning. Moreover, it is relevant to study other factors such as the facilitating or mitigating

conditions with the potential to impact learning outcomes for both the service provider and recipient of educational services via the e-learning method.

This research aims to apply the theory of planned behaviour as the theoretical perspective for inquiry into the effectiveness of e-learning. For this purpose, constructs facilitating or mitigating outcomes of educational service delivery via the e-learning method both on the service provider and service recipient were considered. The research adopts a document analysis approach for testing specific hypothetical propositions, which interrogate specific subjective and behavioural factors along with other identified facilitating conditions. It contributes to the scientific body of knowledge on e-learning, particularly from the perspective of a forced mass adoption of e-learning occasioned by a global pandemic.

2. Theoretical background and development of hypotheses

2.1 Theory of Planned Behaviour (TPB): An extended version

The theory of planned behaviour (Ajzen, 1991) is a theoretical perspective which extends from the theory of reasoned action (Fishbein, 1980), and offers a conceptual framework for understanding contextualized human behaviour. The theory of planned behaviour states that attitude, subject norms, and perceived behavioural control, together shape individual's behavioural intentions and behaviours. The theory has been widely applied in predicting and explaining several learning behaviours (Cheng, 2019). Research into the behavioural psychology of human behaviour has led to the development of several theoretical perspectives, which seek to understand the dynamics with a view to accurately predict human behaviour (Judge et al., 2019; Kuiken, 2015; Tornikoski & Maalaoui, 2019).

This is informed by the consideration and assumption that sensemaking is the central determinant of human behaviour. This assumption is derived from the logic that sensemaking in itself is the process of giving meaning to what is happening in the environment, and these meanings inform and constrain identity and action (Armitage & Conner, 2001; Tornikoski & Maalaoui, 2019). In proposing the theory of planned behaviour, Ajzen (1991) drew inspiration from the assumption that there is an objective world in which behaviour is influenced by the attitude, social norms and perceived behavioural control that an individual has towards a certain behaviour. Hence, these three factors combine in determining or influencing the intention to engage in a specific behaviour. Generally, the utilitarian value of the theory of planned behaviour in the field of academic research is based on its value as a tool for explaining the choices that individuals make with regard to leisure activities, health choices, explaining buyer behaviour, and technology adoption intentions of users (Judge et al., 2019; Seow et al., 2017). Several researchers have applied the theory of planned behaviour in scientific inquiries into the adoption of e-learning as an alternative means of delivering education at various levels of learning and in various societal contexts (Kim, 2021). Richard et al. (2016) applied it from a developing country perspective to investigate the determinants of e-learning adoption among students. Results show that perceived usefulness and attitude towards use had direct effects on e-learning adoption, while perceived usefulness and perceived ease of use also had a direct relationship to the general attitude towards use. Evidence from their study also revealed that variables such as computer self-efficacy and perceived ease of use had an indirect relationship on e-learning adoption, though they were found to have an insignificant direct relationship on e-learning adoption. Moreover, Nyasulu and Dominic Chawinga (2019) also applied the theory of planned behaviour in investigating the adoption of WhatsApp messaging platform as an e-learning medium in Malawi. They found that students reported benefits such as instant sharing of information, academic collaboration, and ability to learn beyond classroom hours. However, they also reported challenges faced by them in adopting such medium to include costs of mobile devices, frequent electricity outages and unreliable Internet connection from mobile network service providers. Also, Chu & Chen (2016) applied the theory of planned behaviour in attempting to understand the impact of group influences on e-learning adoption. Results from their research indicates that user attitude, perceived behavioural control, subjective norms, and social bonds, presented significant positive correlations to e-learning intention. In addition, social identity and social bonds could moderate the effect of subjective norms on intention. Finally, their research shows that intention enhances the time for using e-learning technology rather than frequency.

Evidence from academic research indicates that the theory of planned behaviour is versatile in its adaptability in investigating various behavioural phenomena, particularly in relations to e-learning adoption research (Chu & Chen, 2016; Nyasulu & Dominic Chawinga, 2019; Richard et al., 2016). Sutton (2014) justifies the appropriateness

of the theory of planned behaviour as a theoretical foundation for social science research, and its advantages over other 'social cognition models'. His argument is that TPB is a generalist theory, which makes it preferable to learning or behaviour-specific theories for reasons of parsimony. Sutton (2014) also argues that the theoretical constructs of the TPB are clearly defined and the causal relationships between the constructs clearly specified. Other justifications for suitability are the clarity of recommendations for how the constructs should be operationalised and based on the meta-analyses of observational studies. Results indicate that the TPB accounts for an important amount of variance in intentions and behaviour (Kuiken, 2015; Thoradeniya et al., 2015; Tucker et al., 2019).

In conclusion, a summary of previous TPB research, especially within the online teaching and learning context, can be found in Table 1 and the conceptual framework guiding the current investigation can be found in figure 1.

Table 1: A summary of relevant scientific articles on online teaching and learning

Author/objective	Method	Causal variables	Guiding theories	Key findings	Country
Saleem et al., (2021) analysed students' intention towards e-learning via augmented reality apps during the COVID-19 pandemic.	Structural equation modelling was utilized to analyse data collected from 133 university students.	Attitude, subjective norms, perceived behavioural control, hedonic value, utilitarian value	TPB	Attitude and behavioural control significantly influenced their intention to adopt augmented reality apps for e-learning; and subjective norms showed insignificant results	Pakistan
Jere (2020) explored the factors influencing University lecturers to adopt e-learning platforms	Structural equation modelling was used to assess the data collected from 132 lecturers	Attitude, facilitating conditions, subjective norms, perceived usefulness, perceived ease of use	TAM TPB UTAUT	All constructs had a significantly positive relationship. SNs and PEU showed an influence on PU. Perceived usefulness showed a strong influence on ATU	South Africa
Kim et al., (2021) aim to assess the factors driving greater intention of students to use online learning systems	SmartPLS 3.0 was utilized to analyse the data collected from 187 college students	User innovativeness, attitude, perceived usefulness, subjective norms, PBC	TPB TAM	positive attitudes, perceived ease of use, perceived usefulness, and behavioural intention are significant for the acceptance of online learning systems.	Korea
Anthony et al., (2020) investigated the predictors determining students' blended education adoption	PLS-SEM was utilized to analyse data from 1811 students	Attitude, subjective norm, perceived behavioural control, self-efficacy	TPB TRA	The results show that the attitude, subjective norm, perceived behavioural control and self-efficacy were found to influence students' intention to accept blended learning	Malaysia
Sakka (2022) analysed the determinants for student's acceptance of distance learning at the time of COVID-19	(SEM) was used through smart PLS (version 3.3) to validate the measurement model	Facilitating conditions, social influence, performance expectancy, expected cost, perceived value	UTAUT	The results show that the attitude, subjective norm, perceived behavioural control and self-efficacy were found to influence students' intention to accept blended learning	Jordania

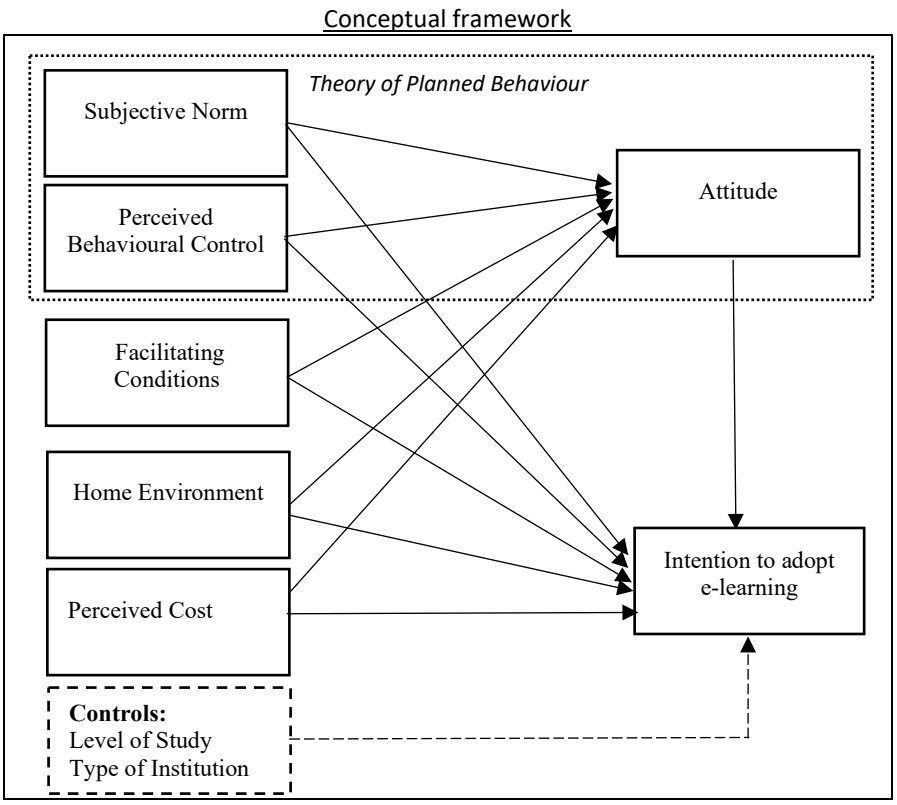

Figure 1: Proposed research model

2.2 Development of hypotheses

2.2.1 2.2.1 Subjective norms, attitude and Intention to adopt e-learning

The notion of subjective norms is often conceptualized as the degree to which an individual perceives social pressures (friends, family, educators, social gathering) regarding a particular behaviour (Ajzen, 1991). According to the TPB, subjective norms are based on the normative beliefs about individuals' expectations (Cheon et al., 2012). Certainly, heterogeneous social groups might have different opinions regarding the adoption of a new technology, particularly in the field of education (Hadadgar, 2016). Accordingly, a plethora of theoretical and empirical studies have explored the subjective norms' impact on students' attitudes towards e-Learning adoption (Sobaih & Hasanein, 2022; Rajeh, 2021). Empirical evidence shows the positive influence of subjective norms on blended learning (Anthony et al., 2020), social network applications (Sobaih & Hassanein, 2022), mobile learning (Hadadgar, 2016) and e-learning (Dos Santos & Okazaki, 2013). However, there is limited research exploring the influence of subjective norms on students' attitudes and intention to adopt e-Learning in the particular crisis context resulting from the Covid 19 pandemic (Saleem et al., 2021). Therefore, the following hypotheses are developed:

$H1_A$: Subjective norms positively affects attitude towards e-learning

$H1_B$: Subjective norms positively affects intention to adopt e-learning

2.2.2 Perceived behavioural control, attitude and Intention to adopt e-learning

The concept of perceived behavioural control (PBC) refers to an individual perception of the level of difficulty that a determined behaviour requires (Ajzen, 1991). Thus, when students have the impression of not having the complete control of a situation while executing a behaviour, they are more likely to not perform it. Conversely, the TPB posits that if intentions are held constant, a determined behaviour will be more likely to be performed as perceived behavioural control increases. This perception of control can significantly influence students' attitudes towards the adoption of e-Learning (Sobaih & Hasanein, 2022). Accordingly, some academics have showed how behavioural control is increased when students have the confidence and the resources required to adopt a learning technology (Anthony et al., 2020). Moreover, a study carried out by Sarosa (2020) showed the determinant role played by PBC among students' intentions to adopt online learning in a pandemic context. PBC

overcame other relevant variables such as perceived cost and required equipment. Therefore, we posit the following hypothesis:

$H2_A$: Perceived behavioural control positively affects attitude towards e-learning

$H2_B$: Perceived behavioural control positively affects intention to adopt e-learning.

2.2.3 Facilitating conditions, attitude and Intention to adopt e-learning

In this research, facilitating conditions (FCs) are the extent to which a student believes the resources required by the e-learning behaviour are available. Technical and organizational infrastructure accessibility can impact the intention to adopt a technology and particularly in the e-learning sphere (Hadadgar, 2016). Accordingly, factors such as skills training, administrative support and network convenience are relevant in the adoption of information and communications technology for learning (Sakka, 2022). Similarly, Jere (2020) studied the drivers influencing e-learning adoption among academics and confirmed the accuracy of the facilitating conditions variable in predicting behaviour in a South African university. In the same connection, Weerathunga et al., (2021) posit that students' behaviours regarding e-learning are strongly influenced by conditions such as free access to online information, data packages at accessible prices and time to spend on compute or another device. Furthermore, Teo (2019) investigated the use of technology for learning processes among students and lecturers in a South-Asian country. Results are consistent with previous research to the extent that it was evidenced the impact of variables such as facilitating conditions, subjective norms and perceived ease of use on the attitude towards a learning technology adoption. Depending on the previous literature, the following hypotheses are proposed:

$H3_A$: Facilitating conditions positively affect attitude towards e-learning

$H3_B$: Facilitating conditions positively affect intention to adopt e-learning

2.2.4 Home environment, attitude and Intention to adopt e-learning

In parallel with the external variables, recent literature indicates that internal variables arising from students' home conditions can also affect attitudes towards the intention to adopt e-learning (Bonanati & Buhl 2021). Undoubtedly, during pandemic times, the home environment acquired more importance to the extent that students must follow classes from their homes or available places with internet connection. Accordingly, Paizan et al., (2021) posit that learning conditions and parental involving are determinant factors influencing adolescents learning process during the pandemic. Thus, environmental characteristics such as a place to study, silence spaces, technical equipment, learning materials, but also parents' strategies aiming to enhance students' participation to school-related tasks can determine the effectivity of distance learning. Indeed, to consider the home environment framework to systemize e-learning adoption intentions is pertinent in the current pandemic context. Furthermore, the use of former and current data can bring new insights that fill an important gap in the field of learning environment occasioned by a global pandemic. Hence, we hypothesize:

H4a: Home environment positively affects attitude towards e-learning

H4b: Home environment positively affects intention to adopt e-learning.

2.2.5 Perceived cost, attitude and Intention to adopt e-Learning

Certainly, despite a potential delivery cost reduction, the proper adoption of distance learning demands the existence of a laptop/desktop or other smart device and a stable internet connection. For students, the cost of communication and equipment can represent a barrier for e-learning adoption. Accordingly, some scholars have explored the impact of perceived cost on the attitude and the behavioural intention to adopt a technology for academic purposes. Considering the transaction cost theory (TCT), Twum et al., (2021) posit that perceived cost has a negative effect on the behavioural intention to adopt an online learning system. On the other hand, Sarosa (2020) applied the TPB to explore the drivers of distance learning adoption among Indonesian high school students and concluded that perceived costs did not have any impact on e-learning behaviour intention during Covid 19 pandemic. Drawing from the literature review, we propose the following hypotheses:

$H5_A$: Perceived cost negatively affects attitude towards e-learning

$H5_B$: Perceived cost negatively affects intention to adopt e-learning

2.2.6 Attitude and e-learning

The positive or negative reaction of students towards the use of a technology with academic purposes considering the perceived outcomes can determine the adoption of an e-learning system (Kim et al., 2021). According to the TPB, if a student perceives a technology can be useful and ease to use, it is likely that student's attitude toward that technology will be positive. Thus, this mind state and judgement influences individual behaviour intention and reflects the level to which students formulate rational plans to engage in an online learning process. A study conducted by Teo (2019) states that attitude performs a determinant role in students' intention to use technology in a South-East Asian context. In the same connection, Saleem et al., (2021) explored Pakistan students' intention towards distance learning and concluded that attitude and behavioural control significantly influenced their intention to adopt augmented reality apps for e-learning. Furthermore, Antony et al., (2020) posit that students' intention to accept blended learning is positively affected by attitude during pandemic times. Therefore, the following hypothesis is stated:

H6: Attitude positively affects intention to adopt e-learning

3. Methods

Since this research is founded in a qualitative examination, researchers adopted document analysis as research technique in order to achieve the overall aim of the paper. Despite being considered by few as simplistic, document analysis is a pertinent and accurate initial point for explaining current global phenomena, given its broader explanation capacity. The document analysis was grounded mainly on current scientific manuscripts found on databases such as SCOPUS, Web of Science, EBSCO and Google Scholar through the use of the keywords "e-learning", "theory of planned behaviour", "Covid 19", "distance learning", "environmental factors" and "academic technology adoption". In the same connection, with the objective of establishing a clear relation across a wide range of research variables, theme analysis was performed in this instance. This analysis allows academics the opportunity to identify potential relations or patterns across extensive research domains with a deductive preestablished objective. Consequently, the gathered information from secondary sources, the researchers' analyses and understanding of the related fields were established and associated to the primary research construct, i.e. intention to adopt e-learning. Furthermore, the current extraordinary context makes it imperative to carry out a document analysis given the increasing academic interest and the undoubtedly relevance for the future of technology use for academic purposes. Indeed, despite this being an extraordinary context, the academic future of the world might include technological factors, considering its potential benefits.

Therefore, the analysis of the theory of planned behaviour in the context of a pandemic crisis can reveal fundamental drivers of e-learning adoption. Certainly, through the investigation of contexts previous to the Covid-19 spread, it is feasible to carry out comparative analyses in order to find patterns and environmental impacts on behaviour intentions. Through literature analysis and the inclusion of relevant constructs in the TPB framework, the objective of this study has been accomplished and the final outcome of the endeavour was the construction of a conceptual framework (see Figure 1). This proposed model was constructed in order to be suitable in different contexts and realities. Finally, it is also pertinent to state that the authors of this study do not make any claim regarding a systematic documentary analysis and the consequent results emerging from the process. Despite the fact that an effort has been performed to identify significantly related themes of the research, with the objective of opening new prospects in the field of e-learning from the perspective of a forced mass adoption caused by a pandemic.

4. Conclusion, implication for theory and practice and limitations

The technological transformations, motivated and accelerated by the pandemic crisis, have allowed humanity to continue with what we consider as "normal life". In the education field, the consolidation of online learning has challenged the current technology adoption models and a genuine necessity of theoretical and empirical evidence able to elucidate this phenomenon has emerged. Accordingly, this research was set out with the aim of proposing a theoretical framework that could provide a deeper enlightenment of the factors enhancing or hindering e-learning adoption during convulsed times. In order to achieve this objective, this investigation has turned spotlight on relevant constructs which could potentially moderate the students' behaviour intentions towards e-learning.

This article makes a major contribution by extending existing literature related to technology acceptance for educational purposes in a context of global pandemic crisis. A theoretical framework is proposed based on the

theory of planned behaviour, the unified theory of technology acceptance, and considering external factors that have been proved to be significant in the e-learning behaviour intention analysis. Undoubtedly, the inclusion of variables such as home environment, perceived costs and facilitating conditions interacting with attitudes towards the behaviour, can bring more insights into the real factors determining online learning systems adoption. The proposed model has the potential to explain a wide range of behaviours related with technology adoption in learning processes and open new prospects for future research.

The main limitation of this study, due to the recentness of the events, is the lack of empirical evidence supporting e-learning adoption dynamics during and after Covid 19 pandemic, particularly among non-developed countries. The proposed model is expected to predict a wide variety of events related with online learning. Nevertheless, the constructs utilized within the proposed theoretical model may not be described as overly comprehensive considering the limited coverage of extant literature and practical evidence. Furthermore, previous literature has confirmed personal traits and cultural values as important predictors in the context of adopting a technological system for education purposes. Therefore, the inclusion of these variables can expand the explanatory capacity of future models to the extent that they are underrepresented in the extant e-learning literature.

References

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50, 179– 211. doi:10.1016/0749- 5978(91)90020-T.

Armitage CJ, Conner M. (2001). Efficacy of the Theory of Planned Behaviour: a meta-analytic review. The British Journal of Social Psychology. 40(4):471-499. https://doi.org/10.1348/014466601164939

Anthony Jnr, B., Kamaludin, A., Romli, A., Mat Raffei, A. F., A_L Eh Phon, D. N., Abdullah, A., Leong Ming, G., A Shukor, N., Shukri Nordin, M., & Baba, S. (2020). Predictors of blended learning deployment in institutions of higher learning: theory of planned behavior perspective. International Journal of Information and Learning Technology, 37(4), 179–196.

Bonanati, S., & Buhl, H. M. (2021). The digital home learning environment and its relation to children's ICT self-efficacy. Learning Environments Research. https://doi.org/10.1007/s10984-021-09377-8

Cheng, E. W. L. (2019). Choosing between the theory of planned behavior (TPB) and the technology acceptance model (TAM). Educational Technology Research and Development, 67(1), 21–37. https://doi.org/10.1007/s11423-018-9598-6

Cheon J, Lee S, Crooks SM, Song J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. Comput Educ. 59:1054–6

Chick, R. C., Clifton, G. T., Peace, K. M., Propper, B. W., Hale, D. F., Alseidi, A. A., & Vreeland, T. J. (2020). Using Technology to Maintain the Education of Residents During the COVID-19 Pandemic. Journal of Surgical Education. https://doi.org/10.1016/j.jsurg.2020.03.018

Chu, S. C., Chen, H. T., & Sung, Y. (2016). Following brands on Twitter: An extension of theory of planned behavior. International Journal of Advertising, 35(3), 421-437

Daniel, J. (2020). Education and the COVID-19 pandemic. Prospects. https://doi.org/10.1007/s11125-020-09464-3

Dondena, C. F., Renzi, S., & Klobas, J. E. (2008). DONDENA WORKING PAPERS. Using the Theory of Planned Behavior with qualitative research. www.dondena.unibocconi.it/wp12%0Ahttp://www.dondena.unibocconi.it

Dos Santos, L. M. R., & Okazaki, S. (2013). Understanding e-learning adoption among Brazilian universities: An application of the decomposed theory of planned behavior. Journal of Educational Computing Research, 49(3), 363–379. https://doi.org/10.2190/EC.49.3.e

Hadadgar, A., Changiz, T., Masiello, I., Dehghani, Z., Mirshahzadeh, N., & Zary, N. (2016). Applicability of the theory of planned behavior in explaining the general practitioners eLearning use in continuing medical education. *BMC Medical Education*, *16*(1), 1–8. https://doi.org/10.1186/s12909-016-0738-6

Jere, J. N. (2020). Investigating university academics behavioural intention in the adoption of e-learning in a time of COVID-19. *South African Journal of Information Management*, *22*(1), 1–9. https://doi.org/10.4102/SAJIM.V22I1.1280

Judge, M., Warren-Myers, G., & Paladino, A. (2019). Using the theory of planned behaviour to predict intentions to purchase sustainable housing. Journal of cleaner production, 215, 259-267.

Karunanayake, P. (2020). The COVID-19 Pandemic. *Journal of the Ceylon College of Physicians*, *51*, 1. https://doi.org/10.4038/jccp.v51i1.7878

Kim, M. J., & Petrick, J. F. (2021). The Effect of Herding Behaviors on Dual-Route Processing of Communications Aimed at Tourism Crowdfunding Ventures. Journal of Travel Research, 60(5), 947–964. https://doi.org/10.1177/0047287520919515

Kim, E., Kim, J., Han, S. (2021). Understanding Student Acceptance of Online Learning Systems in Higher Education: Application of Social Psychology Theories with Consideration of User Innovativeness. Sustainability. 13, 896. https://doi.org/10.3390/su13020896

Kuiken, A. (2015). Theory of planned behaviour and the family business. Nordqvist, M., Melin, L., Waldkirch, L. and Kumeto, G. (Eds), Theoretical Perspectives on Family Businesses, Edward Elgar, Cheltenham

Moock, M., & Mello, P. (2020). COVID-19 pandemic. *Revista Brasileira de Terapia Intensiva*, *32*, 1. https://doi.org/10.5935/0103-507x.20200001

Nyasulu, C., Chawinga, D. (2019). Using the decomposed theory of planned behaviour to understand university students' adoption of WhatsApp in learning. E-Learning and Digital Media. 16(5):413-429. doi:10.1177/2042753019835906

Paizan, M. A., Benbow, A. E. F., Aumann, L., & Titzmann, P. F. (2021). Home-Learning During COVID-19: The Psychological Adjustment of Minority and Majority Adolescents. School Psychology, 37(1), 75–84. https://doi.org/10.1037/spq0000489

Rajeh, M. T., Abduljabbar, F. H., Alqahtani, S. M., Waly, F. J., Alnaami, I., Aljurayyan, A., & Alzaman, N. (2021). Students' satisfaction and continued intention toward e-learning: a theory-based study. *Medical Education Online*, *26*(1). https://doi.org/10.1080/10872981.2021.1961348

Saleem, M., Kamarudin, S., Shoaib, H. M., & Nasar, A. (2021). Influence of augmented reality app on intention towards e-learning amidst COVID-19 pandemic. *Https://Doi.Org/10.1080/10494820.2021.1919147*. https://doi.org/10.1080/10494820.2021.1919147

Sarosa, S. (2020). *The effect of perceived risks and perceived cost on using online learning by high school students learning by high school students*. Sixth Information Systems International Conference (ISICO 2021). 197. 477- 483

Seow, A. N., Choong, Y. O., Moorthy, K., & Chan, L. M. (2017). Intention to visit Malaysia for medical tourism using the antecedents of Theory of Planned Behaviour: A predictive model. International Journal of Tourism Research, 19(3), 383-393.

Sobaih, A. E. E., & Hasanein, A. (2022). Higher Education in and after COVID-19: The Impact of Using Social Network Applications for E-Learning on Students' Academic Performance.

Sutton, S. (2014). Theory of planned behaviour. In S. Ayers, A. Baum, C. McManus, S. Newman, K. Wallston, J. Weinman, et al. (Eds.), Cambridge Handbook of Psychology, Health and Medicine (pp. 223-228). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511543579.049

UNESCO. (2020). COVID-19 Educational Disruption and Response. *Unesco.Org*.

Teo, T. (2019). Students and teachers' intentions to use technology: assessing their measurement equivalence and structural invariance. Journal of Educational Computing Research. 57 (1) 201-225. DOI: 10.1177/0735633117749430

Thoradeniya, P., Lee, J., Tan, R. and Ferreira, A. (2015). Sustainability reporting and the theory of planned behaviour. Accounting, Auditing & Accountability Journal. 28. 7. 1099-1137. https://doi.org/10.1108/AAAJ-08-2013-1449

Tornikoski E, Maalaoui A. (2019). Critical reflections – The Theory of Planned Behaviour: An interview with Icek Ajzen with implications for entrepreneurship research. International Small Business Journal. 37(5):536-550. http:/doi.org/10.1177/0266242619829681

Tucker, M., Jubb, C., & Yap, C. J. (2019). The theory of planned behaviour and student banking in Australia. International Journal of Bank Marketing.

Twum, K. K., Ofori, D., Keney, G., & Korang-Yeboah, B. (2021). Using the UTAUT, personal innovativeness and perceived financial cost to examine student's intention to use E-learning. Journal of Science and Technology Policy Management. https://doi.org/10.1108/JSTPM-12-2020-0168

Weerathunga, P. R., Samarathunga, W. H. M. S., Rathnayake, H. N., Agampodi, S. B., Nurunnabi, M., & Madhunimasha, M. M. S. C. (2021). The covid-19 pandemic and the acceptance of e-learning among university students: The role of precipitating events. Education Sciences, 11(8). https://doi.org/10.3390/educsci11080436

Effectiveness of the Capacity Development Programme on the Creation of IMFUNDO Modules by the University Teachers

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Abstract: The purpose of this study was to investigate the effectiveness of the capacity development programme on the creation of IMFUNDO modules during post-COVID-19 lockdown. The participants were 116 University teachers from the Faculty of A and B. Mixed-method research was used. Data were collected through open-ended and closed-ended questionnaires, and interviews. Quantitative data were analysed using SPSS frequency distribution. Atlas.ti was used to analyse the qualitative data. The results revealed that 109 (90.5%) of the teachers strongly agree and agree that, during the planning phase, the incorporation of IMFUNDO and technology in the curriculum was clearly stated on both the module descriptor and study guide. It was also found that 88 (76.9%) of the teachers strongly agree and agree that they constructed, scaffolded and chunked the learning content and activities based on the IMFUNDO structure for each learning unit of the module. It was further established that teachers were positive, felt great, and received excellent support during the training. It is recommended that further studies be conducted on the implementation and quality of the IMFUNDO modules during COVID-19 lockdown.

Keywords: training, empowerment framework, learning management system, instructional design, online teaching, COVID-19 pandemic, university teachers

1. Introduction

The COVID-19 pandemic forced various sectors, including education, to transform their business models and adopt technology. Technology became the driving force in most institutions. However, it posed a challenge, as most stakeholders were not equipped to use technology as a solution to their daily routine work (Du Plessis, et al., 2022). The acceleration of the pandemic impacted most job and study activities, necessitating its transformation to online platforms, and affecting the daily lives of billions of people (Yu, Liu, Huang and Cao, 2021). This disruption had a substantial impact on Higher Education Institutions. (Du Plessis, et al., 2022).

Most Higher Education Institutions (HEIs) adopted emergency remote teaching during the COVID-19 pandemic (Hodges et al., 2020). In HEIs, the shift to online curriculum delivery transformed the manner in which both students and teachers interact with educational content. (Mbhiza, 2021). This author argues that the COVID-19 pandemic in effect forced the education sector to be responsive to the new paradigm. The researcher may argue that, within the South African context, HEIs experienced substantial digital maturity. The study University of Technology implemented an emergency multimodal teaching, learning and assessment strategy, forcing its teachers to embrace the IMFUNDO learning management system in their teaching practices under trying circumstances. IMFUNDO is the pseudonym for the learning management system (LMS) used at a study university for online and blended learning (Simelane-Mnisi, 2020; Simelane-Mnisi & Mji, 2020; Simelane-Mnis1 & Mokgalaka-Fleischmann, 2022). The IMFUNDO was used by the university teachers to design and developed their modules for more than 16 years. Even though the system existed for long, not all university teachers used it in their teaching practices as it was not compulsory. During the COVID-19 pandemic, the university teachers were required to rapidly transition from face-to-face teaching to online teaching using IMFUNDO.

To support University teachers with the planning, design and development of online modules on IMFUNDO, the study university implemented an Emergency Remote Teaching and Empowerment Programme. The empowerment framework was employed to enhance the digital skills, pedagogy and practice of the teachers. The framework ensured that, even at the rapid speed of adoption, the quality measures of available online materials were adhered to. This was achieved by using the approved Higher Education Qualifications Framework programmes. These programmes were created within the Faculty by means of the incorporation of technology in the curriculum, and constructive alignment. This argument supports Razeed (2021), who stated that it is believed that in explaining the theoretical frameworks used in curriculum design and development, as well as teaching and learning methodologies, other academics and instructional design teams would be afforded the ability to draw inspiration, which could be applied in their own contexts. The researcher can argue that when the initial COVID-19 pandemic lockdown restrictions were implemented at national level, as

the instructional designer in the Faculty of A, she was actively engaged in the curriculum integration and interactive IMFUNDO modules redesign.

Yu et al. (2021) pointed out that the Ministry of Education in China mandated that universities and colleges throughout the country coordinate for teachers to learn online teaching methods during the COVID-19 pandemic. Sumer, Douglas and Sim (2021) opined that teachers needed training and support in order to properly transform their practices during crises and develop online teaching and learning events. For this reason the study University of Technology in South Africa opted the instructional designers as suitable candidates to provide emergency remote teaching support. The goal of the Emergency Remote Teaching and Empowerment Programme (ERTEP) was to assist lecturers in transitioning from traditional teaching to online or remote teaching, integrating various tools of the IMFUNDO to the benefit of the students (Simelane-Mnisi, 2020). This author pointed out that the instructional designers had to ensure that pedagogy took precedence throughout this phase, as technology alone does not guarantee a pleasant or effective learning experience. To further ensure quality, instructional design models were used. The criteria guaranteed that online modules deliver high-quality learning materials, while taking into account the socio-economic status of students (Simelane-Mnisi and Mji, 2020).

The purpose of this study was to investigate the effectiveness of the capacity development programme on the creation of IMFUNDO modules during post-COVID-19 lockdown. To accomplish this, the IMFUNDO teaching and empowerment [training] framework was developed. Survey questionnaires with closed-ended and open-ended questions, and individual interviews were used to determine the effectiveness of the programme on the creation of IMFUNDO modules.

2. IMFUNDO teaching and empowerment framework

The researcher developed the IMFUNDO teaching and empowerment [training] framework (ITEF) as a mechanism in support of University teachers at the Faculty of A and B during the COVID-19 pandemic lockdown. The ITEF was developed and implemented after the conclusion of institution empowerment sessions conducted as supplementary support.

The ITEF ensured that University teachers were equipped with the necessary skills for the planning, design and development of the IMFUNDO modules. It further ensured that all necessary quality standards were met during the empowerment. The quality standards relating to learning outcomes, assessment criteria, learning material (content), learning activities, interactions(collaborations), feedback, and course technology as stipulated in the approved Higher Education Qualifications Framework (HEQSF) curriculum developed. This was formulated to prevent teachers from compromising the quality of the online material (Simelane-Mnisi, 2020). In addition, the concept of constructive alignment was emphasised (Simelane-Mnisi and Mji, 2020). Learning outcomes, learning material (content), learning activities, interactions (collaborations), feedback, and course technology were applied. These ideas coalesce to guarantee students attain the desired learning outcomes (Simelane-Mnisi, 2020). The Do-It-Yourself Approach was applied, since the institution used one instructional designer per Faculty model.

The Arena, Blended and Connected Approach learning design, TPACK, Flipped Learning Approach, Revised Community of Inquiry, and constructivism philosophy served as the basis for the ITEF (Simelane-Mnisi, 2020). During the remote empowerment, various teaching strategies relating to active learning design, scaffolding and chunking, as well as quality issues were utilised. Figure 1 presents the ITEF. To empower and equip teachers with the necessary skills to teach remotely, several online sessions were held. The researcher developed the Remote Teaching and Empowerment Guide, as well as the IMFUNDO module. To read more about ITEF, refer to Simelane-Mnisi and Mokgalaka-Fleischmann (2022).

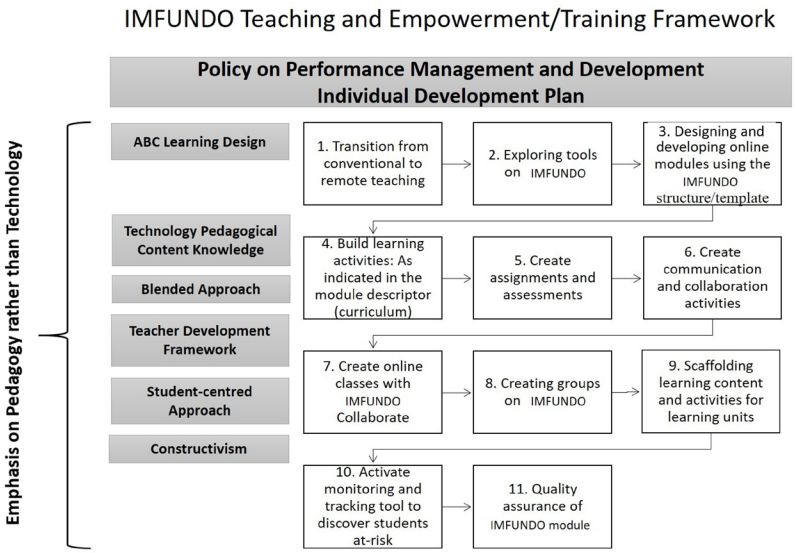

Figure 1: IMFUNDO teaching and empowerment [training] framework (ITEF)

3. Method

The question posed in this study was: How effective was the capacity development programme attended by university teachers to create modules on IMFUNDO during Post COVID-19 lockdown? To answer this question, mixed-method research with embedded design was used. Mixed-method research is rooted in pragmatism theory, which acknowledges and works with the fact that the world is neither purely quantitative nor quantitative; it is a mixed world (Cohen, Manion and Morrison, 2018). Embedded design is when qualitative data is embedded within quantitative data, or vice versa (Leech and Onwuegbuzie, 2009). In this study, qualitative and quantitative data were collected simultaneously through a survey questionnaire with open-ended and closed-ended questions, and by means of interviews. Data were analysed separately; quantitative data were analysed using SPSS frequency distribution. Qualitative data analysis follows Saldaña's thematic approach to analysis (Saldaña, 2015). Thematic analysis is the process of identifying patterns of meaning (themes) through codes (Saldaña, 2021).

4. Participants

The study employed stratified purposive sampling in selecting the participants (Cohen, Manion and Morrison 2018). The researcher selected University teachers from the population of two faculties at the study university. Furthermore, the researcher selected limited cases from these faculties based on purposive sampling. This implies that the participants were 116 University teachers from the Faculty of A (79.5%) and B (24.1%). These teachers were selected because they responded to the online survey questionnaire. Less than three quarters (66.4%) of the teachers were females. Of these females, 66 were from the Faculty of A. The average age group ranged between 46 - 55. Of this age group, 27 teachers were from the Faculty of A. The study further found that 114 teachers made use of IMFUNDO modules.

Table 1: Cross-tabulation of participants' biographical data

Faculty				
		A	B	Total
Gender	Female	60	17	77
	Male	28	11	39
Total		88	28	116
Age	25 – 35	19	7	26
	36 – 45	19	6	25
	46 – 55	27	10	37
	56 - 65	19	4	23
	65 and above	4	1	5
Total		88	28	116
Module on IMFUNDO	Yes	86	28	114
	No	2	0	2
Total		88	28	116

5. Instrument and procedure

5.1 Survey questionnaire

The survey questionnaire consisted of closed-ended questions addressing the quantitative aspects of this study. Part A of the questionnaire gathered data concerning the personal information of the teachers. Part B related to data concerning the design and development of IMFUNDO modules after the teachers were empowered. This instrument consisted of four subscales relating to (a) Planning (5 items); (b) Design (5 items); (c) Development (4 Items); and (d) Perception (3 items).

5.2 Open-ended question

Part C of the survey questionnaire consisted of one open-ended question. The question asked was: How do you feel about the planning, design and development of your IMFUNDO after you attended the training during COVID-19 and national lockdown?

5.3 Interview

To corroborate and triangulate the findings, the individual, semi-structured interviews asked a similar question than the related open-ended question. The interviews were conducted online via Skype, during lockdown. The recorded interviews were then transcribed and sent to the teachers in order to verify whether the data has been accurately captured.

6. Results and discussion

The results revealed the scores for the entire questionnaire comprising of 18 items for internal consistency, the Cronbach's alpha (Cronbach, 1951) values are .87, suggesting that the items have a relatively high internal consistency. This was deemed reliable, as researchers (e.g., Tavakol and Dennick, 2011) point out that a score of alpha above .80 is a good score. The alpha values of the 18 items ranged between .85 - .90.

When teachers were empowered for the planning phase, they were encouraged to use the approved HEQSF curriculum when preparing the material for online delivery. To maintain the constructive alignment and use the appropriate technologies, the curriculum practitioners, instructional designers, and subject matter experts developed the HEQSF programmes. Research revealed that during the pandemic, support models that included IMFUNDO training and support in partnership with teacher experts, were also encouraged (Hodges et al., 2020). It may be observed from Table 2 that, concerning Planning 2 and in development of their own modules, 109 (90.5%) of the teachers strongly agreed and agreed they did access and/or referred to the empowerment guide and IMFUNDO online Faculty module after the training sessions. Sumer et al. (2021) and Lapitan Jr, et al. (2021) argued that the user guide was important during the pandemic phase, as it reduced anxiety among the teachers. Similar results in Planning 3 were found, where teachers (90.5%) indicated that during the planning phase, the incorporation of IMFUNDO and technology in the curriculum was clearly stated on both the module descriptor and the study guide. The results also showed that 102 (88%) teachers agreed and strongly agreed in Planning 1, that they attended the remote empowerment webinars to prepare for the development of IMFUNDO modules. This suggests that most of the teachers deemed it necessary to be granted sufficient time in order to be empowered. This is observed in the study University's (2020) multimodal learning, teaching and assessment strategy that emphasises ongoing staff capacity development to ensure teachers are supported throughout the remote teaching period.

During the design phase, teachers were empowered to use a storyboard to populate learning material that emphasises the scaffolding and chunking of learning content and material, with the selection of relevant technologies. The scaffolding was emphasised during the design stage (Chen, et al., 2021). The results revealed that 110 (94.8%) teachers strongly agreed and agreed that, in Design 5, they created subject contents or materials such as PowerPoint presentations, notes, videos and audio, etcetera. This suggests that most teachers were able to design learning material using various technologies uploaded on the IMFUNDO. In Design 1, the results showed that 105 (90.5%) of the teachers strongly agreed and agreed that, when designing their modules on IMFUNDO, they used the storyboard that was aligned with the module descriptor or study guide to establish learning outcomes, assessment criteria, learning material, select appropriate technologies that encouraged student engagement, and relevant assessment methods for each learning unit. This implies

that most of the teachers maintained the constructive alignment as initially planned on the approved HEQSF curriculum design (Simelane-Mnisi and Mji, 2020).

During the development phase, teachers were given the IMFUNDO template or structure to scaffold and chunk content and activities for each learning unit based on its design. In this case, the results showed that in Development 1, 99 (85.3%) teachers created and built all content and components based on the design phase. This implies that most of the teachers did not deviate from their plan when developing online modules. The results also showed that in Development 2, more than three quarters (76%) of the teachers (88 participants) constructed, scaffolded and chunked the learning content and activities based on the structure for each unit on IMFUNDO. Supporting this result, is Sinnayah, Salcedo and Rekhari (2020), who revealed that the H5P platform was used to foster self-paced and self-directed learning, critically outlining the developmental process involved in scaffolding activities to learning outcomes. The results further indicated that, during Development 4, 86 (74.1%) of the teachers attended the IMFUNDO academic orientation before implementation with the students. It gave them the opportunity to use IMFUNDO as a student, effectively allowing them to align their modules accordingly. The result also revealed that, in Development 3, 108 (93.1%) of the teachers made the module available to students on selected media, and tools of delivery.

Concerning teacher perception, the results showed that 101 (87 %) of the teachers strongly agreed and agreed that, in Perception 1, they liked the idea of using IMFUNDO during lockdown, and they should continue using it even while back on campus. The idea of this study's perception of enjoying IMFUNDO emphasises that the use of an LMS to deliver Online Interactive Activities increases the amount of space and time available for interactive teaching and learning (Chen, et al., 2021). More than three quarters (77%) of the teachers strongly disagreed and disagreed that, at times in Perception 3, they felt lonely while designing and developing IMFUNDO in isolation. The researcher may argue that the Faculty WhatsApp community of practice groups, WhatsApp support from the instructional designer, and other teachers were made available at teachers' convenience to attend to their requests, and provide solutions at any given time during the pandemic. The results further revealed that less than half (46%) of the teachers in Perception 2 enjoyed using IMFUNDO, as it encouraged them to adopt a blended, online approach to teaching. Chen et al. (2021), who stated that Online Interactive Activities and corporate training programs promoted blended and active learning experiences, supports this statement. Lapitan Jr, et al. (2021) further argued that additional outbreaks and impending lockdowns encourage most University teachers to consider synchronous, asynchronous, and blended learning strategies for online teaching.

Table 2: The design and development of IMFUNDO modules frequency distribution

Item		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Planning [(n = %)]						
1	Planning 1	61 (52.6)	41 (35.3)	9 (7.8)	5 (4.3)	-
2	Planning 2	70 (60.3)	39 (30.2)	9 (7.8)	1 (9)	1 (9)
3	Planning 3	44 (37.9)	43 (37.1)	16 (13.8)	11 (9.5)	2 (1.7)
4	Planning 4	59 (50.9)	32 (27.6)	15 (12.9)	8 (6.9)	2 (1.7)
5	Planning 5	55 (47.4)	36 (31.0)	15 (12.9)	9 (7.8)	1 (9)
Design [(n = %)]						
6	Design 1	65 (56.0)	38 (32.8)	10 (8.6)	2 (1.7)	1 (9)
7	Design 2	65 (56.0)	40 (34.5)	9 (7.8)	2 (1.7)	-
8	Design 3	55 (44.0)	49 (42.2)	15 (12.9)	1 (9)	-
9	Design 4	34 (29.3)	45 (38.8)	29 (25.0)	7 (6.0)	1 (9)
10	Design 5	85 (73.3)	25 (21.6)	4 (3.4)	2 (1.7)	-
Development [(n = %)]						
11	Development 1	52 (44.8)	47 (40.5)	10 (8.6)	6 (5.2)	1 (9)
12	Development 2	42 (36.2)	46 (39.7)	20 (17.2)	7 (6.0)	1 (9)
13	Development 3	74 (63.8)	34 (29.3	7 (6.0)	1 (9)	-
14	Development 4	57 (49.1)	29 (25.0)	18 (15.3)	9 (7.8)	3 (2.6)
Perception [(n = %)]						
16	Perception 1	66 (56.9)	35 (30.2	11 (9.5)	4 (3.4)	-
17	Perception 2	14 (12.1)	39 (22.6)	24 (20.7)	18 (15.5	21 (18.1)
18	Perception 3	5 (4.3)	6 (5.2)	16 (13.8)	34 (29.3)	55 (47.4)

6.1 Qualitative findings

In analysing the qualitative data the Atlas.ti Project named 'University Teachers' Capacity Development Programme' was created. Two primary documents (Open-ended question and Interviews) were added to the project. The researcher created 99 codes. These codes were then grouped into nine categories relating to lockdown, training, forced, rapid, IMFUNDO, successful, challenging, time, and support. The theme of capacity development emerged from these categories. Figure 2 presents the conceptual network capacity development.

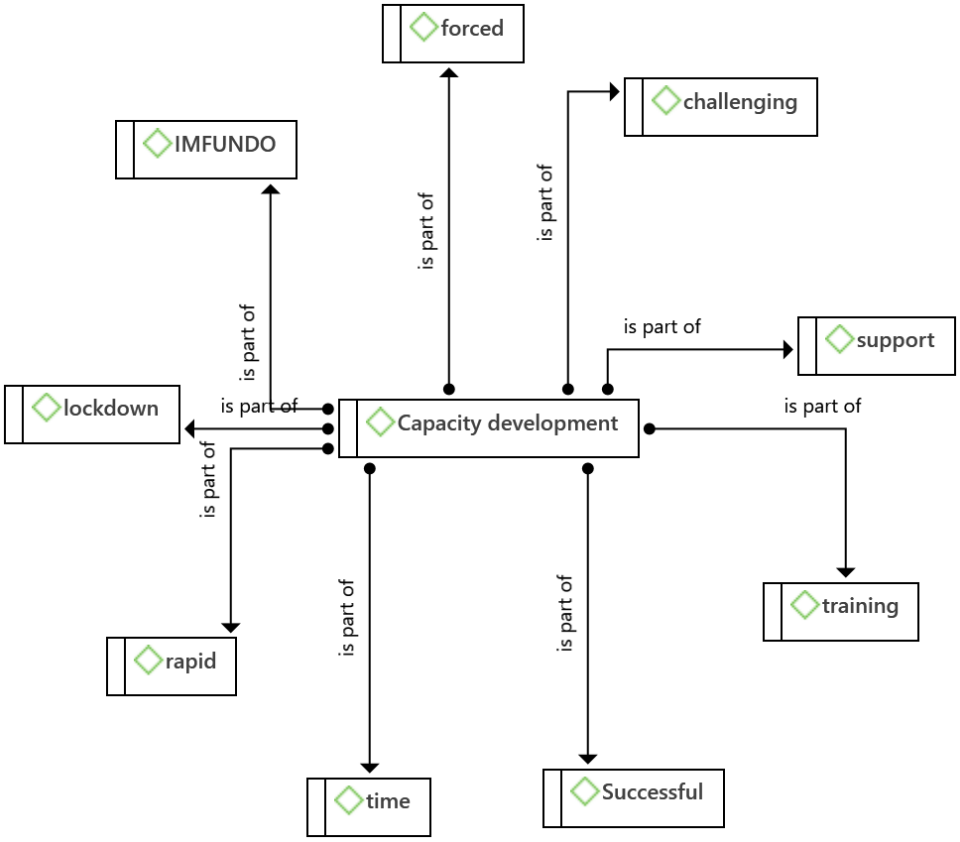

Figure 2: The conceptual network capacity development

6.1.1 Capacity development programme

In terms of Category 1, *Lockdown*, it was established that a number of the University teachers were using IMFUNDO before COVID-19 lockdown, whilst other teachers indicated lockdown forced them to transit all their teaching activities online. Dr Pretorius revealed that *during lockdown*, they *were forced to do everything and demanded a lot of work*. Mrs Vilakazi mentioned that, *although IMFUNDO had been available for some time prior to lockdown, she had only really used it for the uploading of PPT presentations, videos and assignment briefs*. She *has not conducted assessments through this platform*. The International Labour Organization and World Bank (2021) stated that the COVID-19 pandemic, concomitant lockdown and social distancing measures created not only unprecedented disruption in education and training, it also catalysed distance learning innovation. Regarding Category 2, *Training*, the findings revealed that teachers appreciated the virtual trainings that were conducted, as it assisted them to plan. Mr Motaung indicated that *attending the trainings helped* him *to plan and execute the activity well*. Mr Mbatha said *the training assisted to give direction where needed* (P1:20). Dr Diketo felt that *the training was well planned. There were definitely more than enough sessions. However, other teachers did not use it enough to be able to learn it properly. Other teachers should have used it more and more, but the training helped. The online sessions definitely helped*. It may be argued that the Faculty of Teaching and the empowerment framework for University teachers to enhance their digital skills, competency and fluency in difficult times, proved to be successful (Simelane-Mnisi, 2020; Simelane-Mnisi and Mokgalaka-Fleischmann, 2022). This can be attributed to the fact that teachers were able to design their modules using various IMFUNDO tools. Ms Ndlovu indicated that *the training provided was sufficient in terms of learning the tools*.

Concerning Category 3, *Forced*, one of the teachers indicated that, during the COVID-19 lockdown, capacity development to prepare material for online delivery was not by choice, they were forced to do it, though it increased the workload. Dr Sibisi indicated that *during lockdown,* they *were forced to do everything online, and it demand a lot of work*. This statement is supported by Mbhiza (2021), who emphasised that the forced and rushed adjustments in South African universities due to the pandemic seem to be revolutionary in the educational sector. About Category 4, *Rapid*, teachers indicated they had the notion that the institution required them to transit from traditional teaching to remote teaching at a rapid pace, and IMFUNDO was available for support. Mr Maluleke mentioned that *the process was rapid, and offered a world class platform for teaching and learning*. He *could also incorporate practical aspects of his course on* IMFUNDO *platform*. The same sentiments were shared by Prof Mason, who felt that *the transitioning process was good, but rushed. Change was brought about too quickly*. Literature also conquered with teachers in this study, and revealed that globally, while many classes were immediately redirected to online teaching, the process was accompanied by continuous teacher training, and the distribution of routers and laptops to teachers (The International Labour Organization and World Bank, 2021).

In terms of Category 5, *IMFUNDO*, the findings show that most of the teachers revealed they were empowered in the designing of UMFUNDO during a very uncertain time. This is confirmed by 88% of the teachers, who indicated they attended IMFUNDO capacity development during lockdown. Mr Malatji stated that they *were taken through the training for the design and development of IMFUNDO to be used during the lockdown*. The teachers further indicated that the IMFUNDO template was not difficult to use, and ensured constructive alignment. Dr Molotsi said *designing in that new kind of shell was not so difficult*. Furthermore, Ms Mabaso indicated that she *build the module framework and used examples from Engineering Faculty*. It was also found that IMFUNDO assisted teachers to upload learning material so that students could access the information while learning in isolation. Mr Shabangu indicated that *during lockdown* they *had to upload a lot of certain materials for the students*. Literature revealed that most HEIs used LMS during the COVID-19 lockdown (Gumede and Badriparsad, 2021; Sumer, et al., 2021; Lapitan Jr, et al. 2021; Simelane-Mnisi and Mji 2020). Regarding Category 6, S*uccessful*, it was found that teachers viewed the emergency capacity implemented during the COVID-19 lockdown period as successful. The concepts expressing its success were *plan, no problem, easy, effective, learned, lots of material* and *opportunity*. Ms Lee indicated that *attending the trainings helped* her *to plan and execute the activity well*. Dr Maseki revealed that *the planning and the actual offering of the sessions were great. There was no problem with the content and then with the amount of sessions*. Dr Neo said *overall planning and design of teaching were effective, especially with theory*. The findings in this study vary from the report by UNESCO indicating that in Ukraine during the pandemic, all work-based learning activities were suspended, with no apparent plan for it to be resumed (UNESCO, 2021).

Concerning Category 7, *Challenging*, it was established that teachers found the capacity development programme challenging, and they prefer face-to-face training. Mr Mahlangu indicated that *it was challenging and required a lot of training, but it was worth it as* he *was more knowledgeable*. He *still prefer face-to-face class*. Dr Ramashala said *it was challenging because it was not something that they were used to.* They *were doing it, but not intense, the way we were doing it during lockdown*. About Category 8, *Time*, the findings revealed that teachers were given time to attend empowerment sessions. Dr Masilo indicated that she *attended all the online sessions*. She *made time for it because* she *believed that the institution gave them time to actually prepare*. They *needed to make positive use or constructive use of that time that was available*. However, other teachers were devastated by the short time. Dr Mooi felt *overwhelmed with the work that was supposed to be completed in a short space of time*. The findings in the study conducted by Sumer, et al. (2021) revealed that traditional higher education staff members did not have time to prepare for and/or receive support for emergency remote training.

In terms of Category 9, *Support,* it was found that teachers received support from the institution and Faculty instructional designer, eChampions, as well as peers. Dr Dlamini indicated that he *was very happy, because* he has *gained a lot of experience going through all empowerment sessions, as the faculty instructional designer offered informative training*. The research also shows that instructional designers played an important role during and after the pandemic. In this light, Sumer et al. (2021) demonstrated the necessity to connect with staff and support them in an unpredictable environment, allowing them to always focus on the student experience (Sumer, et al., 2021). Mr Maleka mentioned that *the Faculty instructional designer and the team of eChampions really did their best to guide and assist staff members in a short period of time*. Mrs Wild indicated that, *when* she *had to look at her peers and some of the teachers whom* she *was helping,* she *realised that this*

training, when you are alone it was okay. However, she *was lucky, because* she *was part of the teachers that the eChampions from the university helped*.

7. Conclusion

It may be concluded in this study that the University teachers viewed the IMFUNDO emergency remote empowerment programme to be efficient. This was observed by the majority of teachers, who indicated that they pitched for the online sessions. Even though the remote approach to online teaching was adopted, it could be argued that the importance of constructive alignment and alignment of the approved HEQSF curriculum was emphasised to ensure quality and standards were maintained in uncertain times. This imply that even during crises and disruptions caused by natural diseases, viruses and disaster, it is essential for university teachers to adhere to the planned curriculum when emergency learning and teaching is established. University teachers should be afforded with appropriate guidance for online and technology-enhanced pedagogy and andragogy with the support of the instructional or learning designers. The relationship between the subject matter expert, instructional designer and curriculum practitioner needs to be reinforced for better learning outcome that will ensure student engagement, improved performance, and success rate. Furthermore, the support provided by the teachers' empowerment guide, online IMFUNDO module with links to the empowerment sessions, eChampions, as well as the Faculty instructional designer, contributed to the adoption and fast tracking of the development of the modules on IMFUNDO for subsequent implementation in the same year. The limitations to this study were posed by the limited number of participants from two Faculties that were recruited and the low response rate of the survey questionnaire.

8. Recommendation

It is critical for the HEIs curriculum developers, instructional designers and subject matter experts to collaborate when designing and developing online material. The university and the statutory bodies' standards should be adhered to in order to ensure the quality of the modules are maintained, and still produce competitive graduates; even post-pandemic. It is recommended that further studies be conducted on the implementation as well as the quality of the IMFUNDO modules during COVID-19 lockdown. Further studies should be conducted with a larger sample population within a similar context.

References

Chen, L., Manwaring, P., Zakaria, G., Wilkie, S., and Loton, D. (2021) "Implementing H5P online interactive activities at scale", December 2021, ASCILITE 2021, Australia, Armidale, p. 81–92.

Cohen, L., Manion, L., and Morrison, K. (2018) *Research Methods in Education*, (8th Ed), London, Routledge.

Cronbach, L. J. (1951) "Coefficient alpha and the internal structure of tests", P*sychometrika*, Vol 16, pp. 297–334.

Du Plessis, M., Jansen van Vuuren, C. D., Simons, A., Frantz, J., Roman, N., and Andipatin, M. (2022) "South African Higher Education Institutions at the Beginning of the Covid-19 Pandemic: Sense-Making and Lessons Learnt," *Frontiers in Education*, pp. 1-17.

Gumede, L., & Badriparsad, N. (2021) "Online teaching and learning through the students' eyes – uncertainty through the COVID-19 lockdown: A qualitative case study in Gauteng Province, South Africa", *Radiography*. pp. 1-6.

Hodges, C., Moore, S., Lockee, B., Trust, T., and Bond, A. (2020) "The difference between emergency remote teaching and online learning, EDUCAUSE Review", [Online]https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teachingand-online-learning.

Lapitan Jr, L. D., Tiangco, C. E., Sumalinog, D. A., Sabarillo, N. S., and Diaz, J. M. (2021) "An effective blended online teaching and learning strategy during the COVID-19 pandemic", *Education for Chemical Engineers*, Vol 35, pp. 116-131.

Leech, N. L., & Onwuegbuzie, A. J. (2009) "A typology of mixed methods research designs", *Quantity and Quality*, Vol 43, No. 2, pp. 265–75.

Mbhiza, H. W. (2021) "Shifting paradigms: Rethinking education during and post-COVID-19 pandemic", *Research in Social Sciences and Technology,* Vol 6, No. 2, pp. 279–289.

Razeed, A., & Werkhoven, T. (2021) "Design and development of a large business school core interdisciplinary unit to foster blended learning during the pandemic", December 2021, ASCILITE 2021, Australia, Armidale, pp. 257-266.

Saldaña, J. M. (2015) *The coding manual for qualitative researchers,* (3rd Ed.), London, Sage.

Saldaña, J., (2021) *The coding manual for qualitative researchers*, London, Sage.

Simelane-Mnisi, S. (2020) Faculty online or remote teaching support plan.

Simelane-Mnisi, S., & Mji, A. (2020) "Preparing lecturers for remote teaching and flexible learning during COVID-19 pandemic", November 2020, ICERI Virtual Conference (ICERI20), Spain, Saville, IATED, pp. 8621-8629.

Simelane-Mnisi, S., & Mokgalaka-Fleischmann, N. (2022), "Training framework to enhance digital skills and pedagogy of chemistry teachers to use IMFUNDO" In *New updates in e-learning*, pp. 91-110. IntechOpen.

Sinnayah, P., Salcedo, A., and Rekhari S. (2021) "Reimagining physiology education with interactive content developed in H5P", *Advances in Physiology Education*, Vol 45, pp. 71-86.

Study University, (2020) Multimodal learning, teaching and assessment strategy.

Sumer, M., Douglas, T., and Sim, K. N. (2021) "Academic development through a pandemic crisis: Lessons learnt from three cases incorporating technical, pedagogical and social support", *Journal of University Teaching & Learning Practice*, Vol 18, No. 3, pp. 1–14.

Tavakol, M., & Dennick, R. (2011) "Making sense of Cronbach's alpha", *International Journal of Medical Education*, Vol 2, pp. 53–55.

The International Labour Organization and World Bank, (2021) "Skill development in timed of COVID: Taking stock of the initiative responses in technical and vocational education and training", Geneva.

UNESCO, (2021) In support of COVID-19 global educational coalition.

Yu, H., Liu, P., Huang, X., and Cao, Y. (2021) "Teacher online informal learning as a means to innovative teaching during home quarantine in the COVID-19 pandemic", *Frontiers in Psychology*, Vol 12, pp.1–12.

Pre-Service Mathematics Teachers' Lesson Plans as a Source of Information About Their Readiness to Teach Online

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Abstract: This paper presents a study of lesson plans created by pre-service mathematics teachers (PMTs) from two universities (Faculty of Education, Charles University in Prague, and Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava) in the course Didactics of Mathematics. The collaboration of the two research teams brought new perspectives on several questions that were come across in one or the other group of PMTs. The focus of the study was on lesson plans since the lesson plan is one of the significant parts of mathematics teacher education. The studied issues were the PMTs' willingness to implement digital technologies (DT) in their lesson plans and the changes in their lesson plans that could be linked to the COVID-19 pandemic. For data processing, a mixed research design was used. In the qualitative part of the research, the thematic analysis resulted in identification of several codes related to the hybrid mode of teaching. In the quantitative part, Statistical Implicative Analysis (C.H.I.C) was applied. Relations inside the groups of PMTs and among them are presented and discussed in the paper by interpreting the results from the implicative trees and graphs. We concluded that (i) PMTs from our sample are, to a limited extent, prepared for using DT in their teaching, (ii) PMTs used DT in their teaching mainly for testing and feedback collection, (iii) PMTs in our sample focused on the content and the choice of software (or application, applet, etc.) when preparing a lesson plan. Besides that, we found (by using C.H.I.C.) that not all codes identified in thematic analysis were connected to the others. The findings are of interest to teacher educators in general, researchers interested in teachers' lesson planning, and in-service teachers in general. In this paper we focus on PMTs' lesson plans. We plan to do a similar analysis of in-service teachers' lesson plans in order to gain a deeper insight into the role of experience in the studied domain.

Keywords: teaching in online environment, use of digital tools by preservice teachers, lesson plans, teacher training

1. Introduction

The paper focuses on one part of a long-term collaboration of two groups of researchers/teacher educators at two faculties, the Faculty of Mathematics, Physics, and Informatics of Comenius University in Bratislava (Slovakia) and the Faculty of Education of Charles University in Prague (Czech Republic). One currently discussed education topic is the hybrid organization of teaching mathematics at the lower and upper secondary levels. Several problems in online education were identified in both countries; not all were just poor connectivity and technical parameters of computers used by teachers and pupils. Many in-service teachers were unfamiliar with the digital environment, could not use the software properly, did not know how to engage pupils in the learning process, etc. One of the findings from our previous research (Slavíčková and Novotná, 2022a) was that development of digital literacy only in one subject (computing) is not sufficient, and closer cooperation among PMTs' educators in the field of mathematics, technology, and pedagogy is needed.

Experience from schools shows that the pace of integration of DT into teaching is languid compared to the speed of evolution of technology. One important retarder of the successful use of DT in teaching is a lack of teachers' insight into the roles of DT in education. If this information is to improve, information on the potential, advantages, and dangers of activities using DT in teaching is crucial (e.g., Aktumen and Kacar, 2008). Despite the considerable potential of DT in education (e.g., Jančařík and Novotná, 2011), examples from practice show that in many cases, "for show" use of technology contributes very little to the development of mathematical knowledge and may even be counterproductive.

The collaboration of the two research teams opened new perspectives on how to address some questions that both groups worked on. In this paper, we focus on our pre-service mathematics teachers' (PMTs) ability to develop lesson plans on a given topic, considering the use of different digital tools (DTs). We identified this topic as necessary not only because of the COVID-19 situation and sudden shift of teaching into online space but also because of current societal developments and the changes in using DT in everyday life. Since PMTs in our sample

were taught in a hybrid form or fully online, we hypothesized that they could find inspiration in our use of DT for their own teaching.

Learning how to develop a lesson plan is one of the significant parts of mathematics teacher education. The fact that PMTs' learn to develop lesson plans for teaching in a regular lesson does not guarantee they will be able to adapt this plan or establish a new one for online education. It became apparent in the pandemic that not all in-service teachers were prepared to teach in the digital environment. If teachers do not get experience with adequate use of DT in their lessons during their teacher education, we cannot expect them to learn it on their own in their teaching practice.

The COVID-19 pandemic caused teachers to "jump in at the deep end" without resources, knowledge, or support (e.g., Engelbrecht et al., 2020); some results confirm that the "quick transition to the online form of education went successful and gained experience can be used in the future" (Basilava and Kvavadze, 2020, p. 1). Therefore, this issue (remote teaching, digital resources, etc.) should be addressed in teacher training.

The research study was designed to target in-service teachers' issues that were not related to the development of digital skills and literacy but to the use of DT in mathematics (or another subject). That is why the focus of the study was on using DT when preparing a lesson plan with the goal of mapping PMTs' preparedness for transitioning face-to-face environments into digital ones.

2. Theoretical framework

The use of IT in teaching and learning mathematics is not a new topic in mathematics education. It has been broadly discussed from several perspectives in a number of publications. For example, in (Clements et al., 2013), eight chapters are included in Section C: Technology in the Mathematics Education (pp. 517-790). Theoretical as well as practical developments related to the rapid growth of implementing IT in mathematics teaching and learning are discussed. The topics presented are technology in mathematics curriculum (Roberts, Leung and Lins, pp. 525-547), modelling with mathematics and technologies (Williams and Goos, pp. 549-569), role of technology in proving (Sinclair and Robutti, pp.571-596), consequences of the use of CAS for school curriculum (Heid, Thoms and Ziek, pp. 597-641), role of technology in enhancing statistical reasoning (Biehler, Ben-Zvi, Bakker and Makar, pp. 643-689), learning with the use of Internet (Borba, Clarkson and Gaganidis, pp. 691-720), influence of technology on assessment in mathematics (Stacey and William, pp. 721-751) and technology-driven developments and policy implications (Trouche, Drijvers, Gueudet and Sacristán, pp. 753-789). Since it is broadly accepted that teachers have an important role in mathematics education, especially in the fruitful implementation of new ideas and approaches to teaching procedures, all of mentioned topics should be discussed with PMTs to provide them an overview of where, how and why to use, or not use DTs. For example, Kieran, Krainer and Shaugnessy (2013) regard teachers as the key persons making the link between research and practice.

"Teachers of mathematics should master solving mathematical problems, selecting the most suitable problems and procedures for their pupils. Moreover, they should plan and present the lessons so that the activities stimulate pupils' cognitive processes." (as documented in Slavíčková and Novotná, 2022b). To fulfil this important role, they should be equipped with appropriate knowledge and skills already during their teacher education. To get insight into teacher's (or PMT's) thinking about the lesson (e.g., what resources to use, how to organize the lesson, what is the role of teachers, pupils, etc.) we collected their lesson plans. Collected lesson plans were analysed from the perspective of using DT in different ways (from visualization through observation, manipulation to modelling) and related task redesign. Since, as we mentioned sooner, PMTs were trained during the pandemic hybrid form of teaching, we were expecting using their experiences and reflecting them in their lesson plans. Therefore, we stated our research questions as follows:

- RQ1: To what extent are PMTs (for lower and upper secondary school) prepared on shift to a hybrid or fully online environment?
- RQ2: Which components of hybrid/online teaching do PMTs focus on, and which do they accentuate when developing a lesson plan?

3. Methodology

Our research sample consisted of two groups of PMTs in their 1st year of master studies (19 PMTs from Slovakia and 21 PMTs from the Czech Republic). The unifying factors for the groups were: 2 years of online education at the university, studying mathematics on bachelor's degree, similar educational systems (Slovakia and the Czech Republic are the two countries of former Czechoslovakia with similar educational systems). In both universities, the scenario was the same (see Figure 1). Each group was taught how to integrate DT into their teaching. Then PMTs were asked to prepare their own lesson plan (on different topics in each of the countries) and discuss it with their peers and the teacher educator.

Figure 1: Process of collecting data

The developed lessons plans were analysed using the mixed research approach of Concurrent Embedded Strategy (Creswell, 2009). According to Creswell (2009, p. 228) the Concurrent Embedded Design consists of a primary method that guides the project and a secondary method that provides a supporting role in the procedures. In our case, the primary method was qualitative analysis of the gained data (using thematic analysis as defined in (Braun and Clarke, 2006)), the secondary was quantitative procedure using the Implicative Statistic method.

In the qualitative part, we analysed lesson plans developed by the participating PMTs in both groups. We used thematic analysis (see e.g., Braun and Clark, 2006) to identify codes related to the hybrid mode of teaching (see Table 1). For the quantitative part of our research, we applied the Statistical Implicative Analysis of PMTs' solutions using the software C.H.I.C. The goal of this method was to define the way that would allow to answer the question: "If an object has a property, does it also have another one?" (Courtier, 2008). Based on the implication and similarity intensity, C.H.I.C. allows the building of two trees and one graph. It enables the user to handle binary variables, frequency variables, variables over intervals, and interval variables. In the implication graph, we can see the rules with greater intensity than a given threshold. Four thresholds settable by the user are available, and C.H.I.C. uses different colors to show which rules are the most important. The used variables for the implicative analysis were the identified codes presented in Table 1 (the 2nd column – used name of codes).

Table 1: Identified codes related to the hybrid mode of teaching

No.	Used name of codes	Description
1	*real_context*	The mathematical concept is linked with a real-life situation.
2	*key_moments*	Key moments in the lesson, moments when discussion could arise, etc. were identified.
3	*DT_vizualization*	Using DT only as a tool for visualizing the concept by the teacher
4	*DT_manipulation*	Using DT by pupils as virtual manipulation
5	*DT_exploration*	Using pre-prepared situations where students work with DT to explore a mathematical phenomenon (e.g. microworlds, applets for specific characteristics).
6	*DT_online_ environment*	Using DT by pupils to work with and construct new knowledge (e.g. GeoGebra)
7	*DT_online_testing*	Using an online environment to test the students or exit tickets[1]
8	*task_redesign*	Changes of the selected tasks proposed
9	*own_material*	Own material created or a material from a resource modified
10	*tasks_no_changes*	Material from resources used without any modification

[1] Exit tickets are a formative assessment tool that give teachers a way to assess how well students understand the material they are learning in class. (Adapted from: https://www.edutopia.org/practice/exit-tickets-checking-understanding.)

No.	Used name of codes	Description
11	*pupils_special_ needs*	Special activities for pupils with special needs and/or gifted pupils were proposed.
12	*pupils_engaging_ environment*	Inclusive and cooperation supporting activities, creating safe environment for learning and discussion etc. proposed.
13	*changes_to_online*	proposals what to do with the lesson plan in case of online teaching/learning process.

Before implicative analysis, a table with occurrences of the codes in each lesson plan was created. The value assigned to a particular code was chosen from the interval $\langle 0, 1\rangle$ as a value from a six-value scale, where 0 represents no occurrence and 1 means that the code was identified and the supporting activity was described in detail by the author of the lesson plan (one of the PMTs). E.g., if PMT just stated in lesson plan "I'd like to prepare engaging environment for pupils to …" but it was not present in the lesson plan, we assign value 0 to this variable. If PMT's trial with engaging environment was present but not engaging, we assigned one of the values 0.2, 0.4, 0.6, 0.8 according to the reached level.

4. Results

We present results based on the outputs of the C.H.I.C. For easier orientation in the graphs produced by C.H.I.C., we re-draw them.

At first, we looked on our data as a whole. As shown in Figure 2, there are two connected components of the graph.

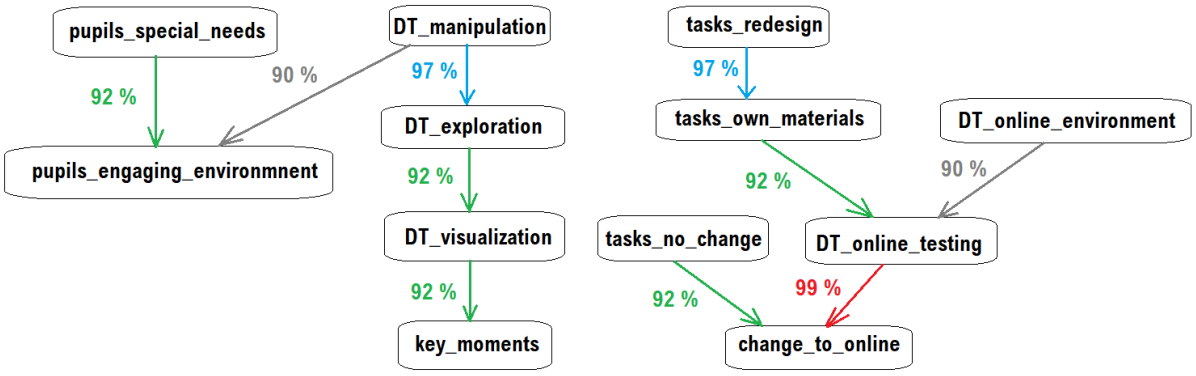

Figure 2: Implicative graph - all codes (re-draw based on C.H.I.C. output)

The first connected component has two main subgraphs:

- The first subgraph starts in the vertex[2] <*pupils_special_need*>: 92% of PMTs who considered pupils with special needs (minority of the PMTs), wanted to prepare an engaging environment for their pupils to eliminate obstacles when learning a new topic. In these cases, mostly GeoGebra or special devices were suggested (e.g. for visually impaired pupils)
- The second subgraph starts in the vertex <*DT_manipulation*>: PMTs who considered using DT as a tool for manipulation in 97% also included DT as a tool for exploration of a phenomenon, and 90% suggested development of an engaging environment for their (hypothetical) pupils. Furthermore, in case of PMTs who would use DT as a tool for exploration, 92% would use it as visualization tool and 92% identified the key moments of the teaching/learning process.

The second connected component consisted of three subgrahps:

- The first subgrahp starts in the vertex <*task_redesign*>, it works with the PMTs who redesigned several tasks from different sources (e.g. textbooks, workbooks, internet, etc)
- The second subgraph starts in the vertex labelled <*DT_online_environment*> works with the PMTs who were designing their lesson plan for on-site and on-line teaching parallelly.

[2] Vertex (or node), see e.g. https://www.maths.ed.ac.uk/~v1ranick/papers/wilsongraph.pdf, p. 2, definition of concepts

- The third subgraph starts in the vertex <*task_no_changes*> and works with the PMTs who used their lesson plans tasks from different sources that were cited in their lesson plans.

The PMTs who redesigned existing tasks in 97% also included their own tasks and thought about using DT for online testing of their (hypothetical) pupils. 92% of them would use an online test (majority of the PMTs) or exit tickets (minority of the PMTs), and 99 % of them considered also "plan B" for situations of online teaching. The code <*changes_to_online*> was present in 92% of lesson plans of PMTs who did not adapt tasks from some original source. Furthermore, 90% of the PMTs who considered working with pupils in an online environment would test the pupils also digitally.

Since we were interested especially in the use of DT, we focused on the codes 3-7 described in Table 1 separately. There are two groups of students identified (see Figure 3).

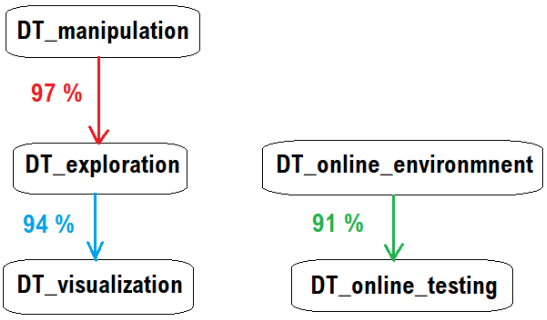

Figure 3: Planned different use of digital tool in PMTs lesson plans (re-draw based on C.H.I.C. output)

PMTs who considered using DT for manipulation in 97% considered also using DT as a tool for exploration and in 94% as a visualization tool. PMTs would prefer pupil's individual or pair work with DT (computer or mobile devices depending on the topic) with software suitable for the pupils' age and the topic. Several PMTs also described applets in English to support pupils' understanding. Some of the applets were inappropriate (e.g. too difficult to understand the concept, new difficult terminology, not correctly prepared, etc.). PMTs who mentioned in their lesson plans visualization activities would do so only in the case when pupils would not have enough devices or if there were problems with internet connection. We found this important since this could lead to modelling in later stages of teaching/learning process.

Then we analysed the group of the PMTs who considered online environment in their lesson plans and in 91% they would like to test their (hypothetical) pupils using online tests (majority of PMTs) or asked for online exit ticket (minority of PMTs). In this group, 86% of PMTs would use DT as a visualization tool even when pupils were working in the online environment. The reason identified in the analysed lesson plans was "to save some time", which we do not consider as a well justified reason. Online environment in these lesson plans was only used as a space for attracting pupils' attention or for keeping them active. In some cases, we found those activities counterproductive (e.g., shooting on fractions as part of a game could disturb pupils).

As our data shows that the <*real_context*> was only one of the variables and is not present in the implicative graphs above. Therefore, we plotted another implicative tree to get better insight into the connections among the codes (Figure 4).

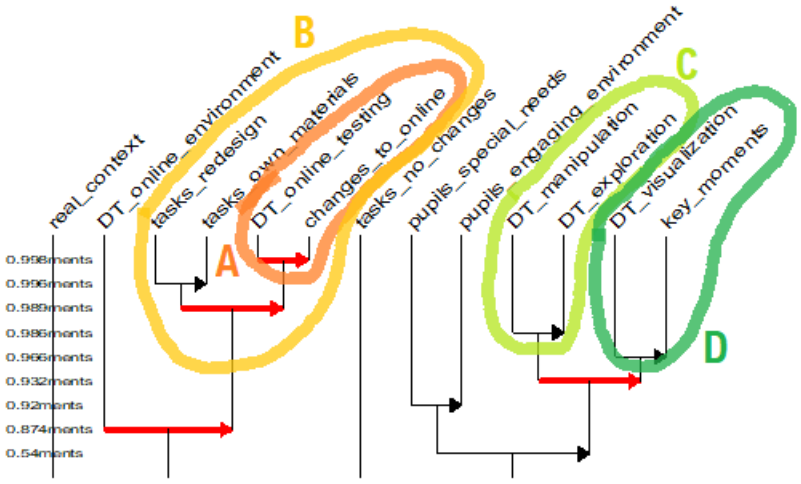

Figure 4: Implicative tree (original outcome from the C.H.I.C. software with added marks A, B, C, D for easier orientation and description in the text)

As can be seen in Figure 4, the *<real_context>* did not play an important role in PMTs lesson plans.

The Implicative tree shows there are 4 significant implications among the codes:

- **A**: Using <DT_online_testing> implies <changes_to_online_environment>
- **B**: Cluster {<task_redesign>, <task_own_materials>} implies **A**
- <DT_online_environment> implies **B**
- **C**={<DT_manipulation>, <DT_exploration>} implies **D**={<DT_vizualization>, <key_moments>}

The first three bullets have already been discussed in the subgraph of Implicative graph in Figure 2. However, all four bullet points were not identified in Figure 3 focusing on using (or mentioning) DT in the PMTs lesson plans. For example, the label *<key_moments>* is absent from Figure 2. Therefore, we looked on our data again using the Implicative tree to find out how identification of the key moments in the PMTs lesson plans is connected to the usage of DT (see Figure 5).

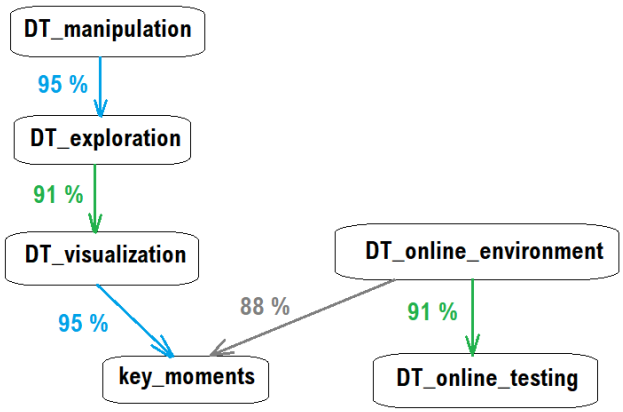

Figure 5: Implicative graph - using DT and identification of key moments (re-draw based on C.H.I.C. output)

Lowering the probabilities of occurrences of other variables, we identified two cases in which the PMTs identified the moments crucial for pupils' understanding of the phenomenon in their lesson plans:

- 95% of the PMTs who considered using DT for virtual manipulation in their lesson plans also considered DT as a tool for exploration, 91% of them would use DT as a visualization tool and 95% of them identified the key moments.

- 88% of the PMTs who prepared their lesson plan considering work online identified the key moments in their hypothetical classrooms.

Even though several PMTs tried to include tasks with real-life context, it had no impact on the use of DT or other variables/codes.

5. Discussion

When comparing our findings with (Clements et al., 2013), we confirm that PTMs focus on learning using the internet (Borba, Clarkson and Gaganidis, in Clemens et al, pp. 691-720). The studied groups of PMTs would use DT as a tool for assessment similarly to Stacey and William (in Clemens et al, pp. 721-751) or as a tool for virtual manipulation. In later stages, proper manipulation could lead to modelling using DT as mentioned in Williams and Goos (pp. 549-569). In PMTs' lesson plans there was a visible link between research and practice, as mentioned by Kieran, Krainer and Shaugnessy (2013). This link was observable in the lesson plans in which our PMTs included the most actual topics discussed in the lessons (e.g., inclusive teaching/learning environment supported by DT, "good questions", implementation of DT as a tool for manipulation and observation).

Answering the first research question RQ1: *To what extent are PMTs (for lower and upper secondary school) prepared on shift to a hybrid or fully online environment?* we conclude that PMTs from our sample are, as their lesson plans show, prepared for using of DT to a limited extent. The application of DT most used in their teaching was for testing and feedback collection. We do not find this sufficient. Therefore, more specific examples of pedagogically meaningful ways of using DTs in education for PMTs to gain the knowledge and confidence to use DT in education (Ertmer and Ottenbreit-Leftwich, 2010; Slavíčková and Novotná, 2022). We also suggest that a higher emphasis on using DT as a modelling tool is needed not only in courses of didactics of mathematics but also in mathematical courses in Bachelor and Master studies.

Answering the second research question RQ2 *Which components do they focus on and are stressed when developing a lesson plan?* we identified two most accentuated areas our PMTs' lesson plans:

- Content – what tasks we will work with in the lesson
- Chosen application – in many cases only name, or kind of the application was provided without the description of how to use the chosen app (e.g., we can use GeoGebra, Kahoot, learning apps, etc.)

These two areas the PMTs paid attention to, could be the result of several factors, e.g., how they were taught on secondary school, during their bachelor's degree or in another subject. We plan to focus more on these factors in our future research.

6. Conclusion

The here reported research study is a part of a larger project. In the next step of our research, we plan to focus on factors identified in the discussion, mainly how the PMTs in our research sample are prepared for mathematics lessons, what their background is, etc. (the so-called context and need analysis) and prepare a new intervention. Cooperation with in-service teachers could be useful in this step, as well as focus on in-service teachers' education (lifelong learning).

The presented study confirms that closer cooperation among teacher educators from different institutions in one country or from different countries is needed. It could be beneficial for all participants. It could result e.g., in deeper changes in the organization of pre- and in-service education of (not only) mathematics teachers.

In our study, 40 PMTs participated. The gained results cannot be generalized. However, they indicate some ways in which the training of PMTs for their future work could be improved.

Acknowledgements

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References

Aktumen, M., and Kacar, A. (2008) Effects of computer algebra systems on attitutes towards mathematics. *Hacettepe Universitesi Egitim Fakultesi Dergisi-Hacettepe University Journal Of Education,* Vol. 35, pp. 13-26.

Basilaia, G.; Kvavadze, D. (2020) Transition to online education in schools during a SARS-CoV-2 coronavirus (COVID-19) pandemic in Georgia. *Pedagogical Research*, 5, 1–9.

Braun, V., and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, Vol. 3, pp. 77–101.

Clements, M.A. (Ken), Bishop, A.J., Keitel, C., Kilpatrick, J. and Leung, F.K.S. (Eds.), *Third International Handbook of Mathematics Education*. New York: Springer. DOI 10.1007/978-1-4614-4684-2_22

Courtier, R. (2008) CHIC: *Cohesive Hierarchical Implicative Classification*. Retrieved from: https://www.researchgate.net/publication/225687933_CHIC_Cohesive_Hierarchical_Implicative_Classification [accessed January 19, 2022]

Creswell, J. W. (2009) *Research design. Qualitative, Quantitative, and Mixed Methods Approaches*. Third edition. SAGE.

Engelbrecht, J.; Borba, M.C.; Llinares, S.; Kaiser, G. (2020) Will 2020 be remembered as the year in which education was changed? *ZDM Mathematics Education,* 52, 821–824

Ertmer, P. A., and Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, 42(3), 255–284

Jančařík, A., and Novotná, J. (2011). Potential of CAS for development of mathematical thinking. In M. Kováčová (Ed.), *Aplimat 2011,* Bratislava: STU in Bratislava, pp. 1375-1384.

Kieran, C., Krainer, K., and Shaugnessy, J.M. (2013). Linking research to practice: Teachers as key stakeholders in mathematics education research. In Clements, M.A. (Ken), Bishop, A.J., Keitel, C., Kilpatrick, J. & Leung, F.K.S. (Eds.), *Third International Handbook of Mathematics Education*. New York: Springer, pp. 361-392. DOI 10.1007/978-1-4614-4684-2_22

Slavíčková, M. and Novotná, J. (2022a). Possible approaches for the pre-service mathematics teacher's preparation to apply the digital technology in their own teaching. *Proceeding of CERME 12*, Italy. (accepted)

Slavíčková, M. and Novotná, J (2022b). Analysis of prospective mathematics teachers' lesson plans. In: J. Fejfar, et al. (Eds.), *Proceedings of the 19th international conference Efficiency and Responsibility in Education 2019* (ERIE). Prague: Czech University of Life Sciences, Faculty of Economics and Management. pp. 143-149.

Analysis of Individual Conversational Volatility in Tandem Telecollaboration for Second Language Learning

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Abstract: Second language (L2) learning can be enabled by tandem collaboration where students are grouped in video conference calls while learning the native language of other student(s) on the calls. This places students in an online environment where the more outgoing can actively contribute and engage in dialogue while those more shy and unsure of their second language language skills can sit back and coast through the calls. We have built and deployed the L2L system which records timings of conversational utterances from all participants in a call. We generate visualisations including participation rates and timelines for each student in each call and present these on a dashboard. Students can self-reflect and perhaps target improving their levels of engagement for subsequent calls. We have recently developed a measure called personal conversational volatility for how dynamic has been each student's contribution to the dialogue in each call. This measures whether a student's contribution was interactive with a mixture of interjections perhaps interrupting and agreeing with others combined with longer contributions, or whether it consisted of regular duration contributions with not much mixing. We present an analysis of conversational volatility measures of a sample of 19 individual English-speaking students from our University at lower intermediate-intermediate level (B1/B2) in their target language which was French, in each of 86 tandem telecollaboration calls over one teaching semester. Our analysis shows that students varied considerably in how their individual levels of engagement changed as their telecollaboration meetings progressed. Some students got more involved in the dialogue from one meeting to the next while others did not change their interaction levels at all. The reasons for this are not clear from the data we have and point to a need for further investigation into the nature of online tandem telecollaboration meetings. In particular there is a need to look into the nature of the interactions and see if the choices of discussion topics were too difficult for some lower intermediate students and that may have influenced their engagement in some way.

Keywords: language learning, telecollaboration, conversation metrics, conversational volatility

1. Introduction

Second language learning (L2) can be supported by a pedagogical approach known as tandem telecollaboration where students are grouped into video conference calls while learning the native language of other student(s) on the calls (O'Dowd, 2018), (Wang and Wang, 2019). The first half of such online calls are carried out in the native language of the first group of students which is also the target language of the second group, and for the second half of the call the language used in the conversation is reversed and becomes the native language of the second group and the target of the first. Tandem telecollaboration has become popular over the last decade and especially very recently in our university as a result of teaching and learning having pivoted to more online activity as a result of the COVID pandemic.

Tandem telecollaboration places students in an online environment where more outgoing students can actively contribute and engage in the conversation while those more shy and unsure of their L2 language skills can sit back and coast through the calls but only if they are also partnered with a local fellow student. If a shy student is the only one from a given institution then s/he is forced to talk and to interact more. We have built and deployed the L2 Learning system which records the exact timing of all conversational utterances from all participants. This timestamped transcription of calls can be used to generate a range of metrics on participants' levels of interaction and contribution and this itself becomes a useful tool for students to reflect on their language learning during those online calls. The L2 Learning system has been in use in our university and in partnerships with seven other Universities, supporting hundreds of students in our University learning French, Spanish, German, or Italian as second languages, and students in Universities in those countries learning English as a second language (Dey-Plissonneau et al, 2021a). In total almost 1,000 hours of recorded online meetings have been analysed, visualised and used by students to support their L2 learning.

In the L2 Learning system we generate visualisations as shown in Figure 1 below including participation rates and interactive timelines for each student's participation in each online call and we present these on an online dashboard, personalised for each student. Students can self-reflect on their language learning by playing back various parts of the video recordings of their calls and navigating to parts where their contributions were the greatest, or the parts where they were silent. They can then use this self-reflection to target improving their engagement levels for subsequent calls.

As part of the analysis of student engagement in their tandem telecollaboration calls, we include a measure called conversational volatility which is a quantification of how dynamic and interactive a recorded call has been. This is visualised on the online dashboard and allows students to see an indication of the level of interaction among participants in a meeting before commencing playback of that online meeting. Calls with high levels of conversational volatility tend to be highly interactive and animated, with multiple student contributions with short duration affirmative confirmations and agreements mixed with longer contributions with lots of interruptions from others. Such animated conversations whether held online via video conferencing or face to face, are engaging and usually enjoyable for participants, and we hypothesise will probably lead to better language learning.

We have recently extended the measure of conversational volatility as applied to a whole meeting, to a measure called personal conversational volatility representing how dynamic has been each student's individual contribution to the dialogue in each online call. This measures whether a student's contribution was interactive with a mixture of interjections perhaps interrupting and agreeing with others combined with longer contributions, or whether it consisted of regular long, or short, contributions with not much mixing.

We present an analysis of conversational volatility measures of 19 individual native English speaking students from our University who are learning French, in each of more than 86 tandem telecollaboration calls over one teaching semester. This subset of students is an extract of just one class/course and allows us to do a deeper dive into what the values of the measure tell us. We analyse 67 hours of Zoom recordings and investigate how the levels of engagement in conversations by students who are at lower intermediate to intermediate levels in their target language, change throughout the semester as they take part in weekly telecollaboration calls. We can examine how many actually improve their interaction levels and by how much. Our analysis also shows how participation rates in those calls improve throughout the semester as students gain confidence in their own conversation abilities as they converse with native speakers of their target language.

The rest of this paper is organised as follows. In the next section we present a brief overview of the L2 Learning system, followed by an introduction to the nature of turn-taking in spoken dialogue and the conversational volatility metric previously introduced. We then present the analysis of our results followed by conclusions.

2. The L2 Learning system

The L2 Learning system is a web-based platform that allows students to upload the recording of their online tandem telecollaboration meetings, scheduled as part of their learning of a second language, and is described in Dey-Plissonneau et al (2021b). The process for students is as follows. Having registered on the L2 Learning system, students use the system to register a forthcoming meeting and are issued with a unique meeting code which is shared among all participants in that online meeting. They then use the Zoom platform to host and record their meeting. Importantly, the student hosting the Zoom meeting will have set her/his Zoom recordings to record to the cloud and to generate a recorded transcript of the meeting.

Some time after the meeting is completed, the hosting student receives email notifications from Zoom that their video recording and their audio transcript is available, the latter as a file in VTT format. VTT refers to Web Video Text Tracks (WebVTT) format and it contains supplementary metadata about a video file, in this case a timestamped transcript of the spoken audio, generated by Zoom. The hosting student then uploads links to the Zoom video recording and the VTT file to the L2 Learning system and within a few minutes all student participants in the meeting receive notification and a link to the visual dashboard for that meeting.

A screengrab of a sample meeting is shown in Figure 1 indicating a video playback window in the centre of the screen with 3 participants whose faces are blurred, and a timeline along the top of the screen with one colour (blue, red and yellow) for each participant. This shows when and where each participant contributed to the

dialogue (clearly participant 1 in blue had more to say than the others), Clicking any point on this timeline jumps the video playback window to that point in the video and commences video playback from that point, so the timeline is both for visualisation and video navigation. The dashboard also includes a summary of each participant's amount of participation (shown as a percentage to the right of the timeline and also as a pie chart on the bottom centre), and a chord graph of conversation flow illustrating the ordering of speaker turn-taking.

The final component of the dashboard is conversational volatility which is described in the next section. On the dashboard this appears as calculated for the entire meeting and for the first and second halves of the meeting as a bar chart (in blue) on the bottom left of the screen reflecting the French-speaking and English-speaking halves of the meeting respectively. This was introduced by Del-Plissonneau et al. (2022) and is a useful measure for students to support them as they reflect on an entire meeting. However it is not personalised in any way so in this paper we introduce conversational volatility for individual meeting participants, which we describe in the next section.

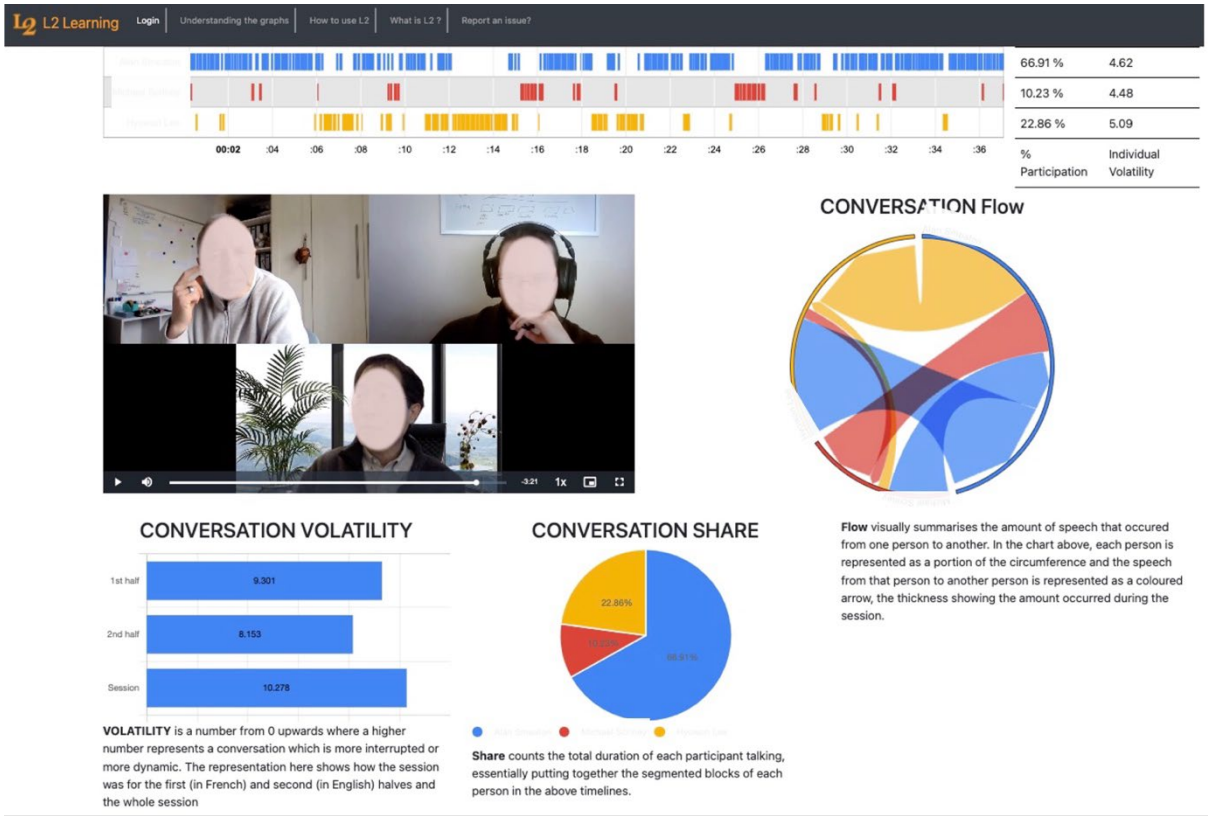

Figure 1: Screengrab of the visualisation dashboard for the L2 Learning system showing the analysis of an online Zoom call

3. Conversational volatility and the L2 Learning system

Research into the nature of multi-participant dialogue has been ongoing for decades but like many other aspects of computational linguistics has been accelerated by the availability of corpus data for researchers to work with. The largest example of this, published by Lowe et al (2015) contains more than 7 million utterances from multi-participant dialogues representing more than 100 mullion word occurrences from text chats rather than from aural conversations. Conversations are our focus and the differences between written and spoken language has been well explored, for example by Wallace and Tannen (1987). Researchers have tried to model the nature of spoken language and dialogue, ultimately with the aims of understanding it and being able to build computational systems that mimic it accurately.

The role of short utterances in online video conversations is especially interesting to us here as we seek to explore how students engage on online Zoom conversations. Li et al (2014) report a quantitative study of three specific short utterances, namely *that's right*, *that's true*, and *that's correct*, and their variants. Their findings are that use of such phrases are to accept, to assess or appreciate a statement made by another participant, or to give an affirmative answer to a point made or a question asked by another participant. These are all examples

of engagement and involvement in the dialogue. Earlier work by Edlund et al (2010) studied very short utterances and what constitutes them and prior to that, Traum and Heeman (1996) had sought to define a consensus on what defines a short utterance, concluding that it is from a single speaker without interruption, constitutes a single turn, is complete, defines a single speech act and is an intonational phrase, with a pause separating it from the next utterance.

In the work we report here, the definition of an utterance is that it is a contribution to an online video conversation which is of long enough duration and distinct enough to have been picked up by an automatic speech transcription facility and the utterance attributed to a change of speaker. Thus this conforms to Traum and Heeman's 1996 consensus definition of an utterance. Whatever definition we use however, assumes that by contributing an utterance to a conversation, a participant is demonstrating their continued engagement in that conversation, even while not actively speaking and that is what we want to measure.

While we focus here on analysis of the audio, or more correctly an analysis of the audio transcript, there are other non-verbal cues which participants use in everyday dialogue. In face to face conversations we use gestures and eye contact although these do not transfer easily to the videoconference environment. In Ishi, Ishiguro and Havita (2017) the authors explore the relationship between head motion such as nodding or shaking, and speech in multi-speaker free dialogue conversations and these non-verbal cues are present in online videoconference meetings when participants' cameras are switched on. They found that head motions may convey information as a form of backchannel and that the strength of this and its usage depends on the prior relationships among speakers, including familiarity with each other. It would be interesting to extend our work to capture non-verbal clues from analysis of the video stream and use this to measure engagement level following similar work by Lee et al (2021) which has been reported to measure engagement levels of students in Zoom lectures but that is outside the scope of this paper.

Historical volatility (Ederington and Guan, 2006), is a well-known measure in statistics with common applications in economics and finance, especially in predicting time series values such as those associated with stock markets where it is used in assessing financial investment strategies. . It is formally defined as the degree of variation of values of some continuous time series over time, usually measured by the standard deviation of changes in values such as daily stock prices.

In this paper we apply the historical volatility measure to turn-taking in dialogue from telecollaboration meetings and we call it conversational volatility. The rationale behind using it is that values of conversational volatility will indicate whether the dialogue was truly interactive and composed of mixtures of shorter and longer utterances, such as when people interrupt each other, or whether it consisted of long monologues with likely tedious turn-taking.

Conversational volatility for the dialogue from entire meetings was introduced in Del-Plissonneau et al. (2022) and applied to the dialogue contributions from all participants in a tandem telecollaboration call, and we refer to this as meeting conversational volatility (m-CV). Individual speaker conversational volatility (i-CV) is defined in a similar way to m-CV. It is the standard deviation of the change in duration between adjacent utterances except that for i-CV we calculate this for the utterances from each speaker in turn whereas for the meeting it was calculated for the utterances from all speakers. The relationship between the value for m-CV and the i-CVs values for the individual speakers during that meeting is unpredictable and depends entirely on the composition of the meeting and the participation of the contributors and their levels of interaction and engagement in the meeting. Where any participant contributes a the meeting dialogue with short duration utterances or affirmations such as "Yeah", or "Umm" or "Oui" or disagreements such as "Naw" or "Arrgh" and that participant mixes those with longer duration and thus more meaningful contributions, then that individual's i-CV will be high. Correspondingly, for a participant who engages only with short duration affirmations, agreements or disagreements, or who engages only with long duration contributions and then stays out of the conversation, then that individual's i-CV will be low.

To demonstrate how CV values for participants in the same meeting can vary we will illustrate by example, in the style of Anscombe's quartet (Anscombe, 1973). Anscombe's quartet is a famous example in data science of a collection of 4 datasets with almost identical descriptive statistics but when visualised they reveal very different distributions of their values. In Figure 2 we show a fragment of a Zoom meeting between 2 participants, labelled Speaker 1 and Speaker 2. The top row of grey blocks indicates both the times and durations when

Speaker 1 spoke and the second row indicates the same for Speaker 2. The row of numbers at the bottom of the Figure shows the durations of each utterance from each speaker in seconds, so it shows 4 seconds for Speaker 2 followed by 2 seconds for Speaker 1 followed by 2 seconds for Speaker 2, etc. The values shown are for a 60 second clip taken from a recording of an actual interaction on a recorded 2-person Zoom meeting, with the values of the utterance durations rounded to the nearest second.

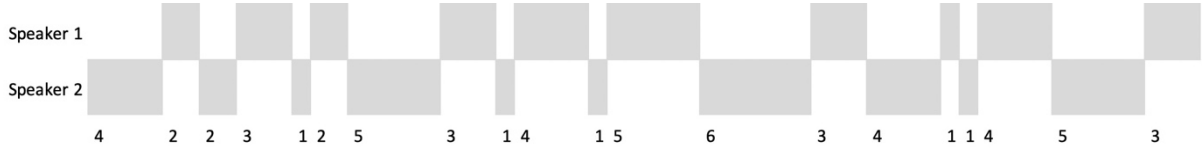

Figure 2: Illustration of turn taking and durations of contributions from 2 speakers in an extract from a sample Zoom meeting among two colleagues

From a visual inspection of Figure 2 we can see that each of the speakers spoke for the same overall duration, 30 seconds each, and each speaker's contributions varied from just 1 second (probably an affirmation or a disagreement with a point being made) and a maximum of either 5 or 6 seconds. Speakers also made the same number of contributions (10 each, 20 in total) to the 60-second clip so at first glance the two speakers would appear to be equal in terms of their contributions to the discussion. This is summarised in Table 1. However, exploring this more deeply through individual CV values reveals subtleties not immediately apparent.

Table 1: Conversational volatility measures for an extract from a sample Zoom meeting

	Speaker 1	**Speaker 2**
Duration of overall speech	30 seconds	30 seconds
Individual Conversation Volatility (i-CV)	1.09	2.44
Meeting Conversational Volatility (m-CV)	1.42	

In Table 1 we see the computed conversational volatility measures for each individual speaker (i-CV) and for the whole of the sample 60-second clip including all speakers from the student meeting (m-CV). This indicates that the value of Speaker 2's i-CV is more than twice that of Speaker 1, and that m-CV lies between the two i-CV values, but not at the mid-point. Higher values of conversational volatility, either individual or on entire meetings, correspond to a greater mixture of longer and shorter duration contributions. This short example illustrates the value of adding individual conversational volatility as feedback to student participants in tandem telecollaboration, so they can reflect on what the meeting was like as a whole (m-CV) and also on their own contributions and the contributions of others to the meetings (i-CVs).

4. Results and analysis

The 19 students from our University, chosen for this analysis are native speakers of English and are learning French at lower intermediate to intermediate levels. They conduct telecollaboration meetings with students from a University in France who are native speakers of French and who are learning English. Table 2 presents the characteristics of the data used.

Table 2: Characteristics of dataset used

Number of students	19
Number of Zoom meetings	86
Total duration of meetings	66 hours, 57 minutes
Average duration of meetings	47 minutes
Average number of participants per meeting	3 or 4
Average speaking time per student for entire meeting	38%

All of the 86 Zoom telecollaboration calls with 1 exception had either 3 or 4 participants. The average speaking time for our 19 students in these calls was 38% and with an average of 3.4 participants this means that these students contributed more to the conversations in terms of their speaking time, than other participants, their peers from France. There is no real explanation for this except to note that the English-speaking students learning French tended to speak more than the French-speaking students learning English.

We computed conversational volatility for each meeting (m-CV) and our initial interest is in how this progresses from the first to last meeting. The average m-CV across all 86 meetings was 7.596 and the average m-CV for the first, second, etc. meeting across all students is shown in Table 3 while the distribution of those m-CV values is shown in Figure 3 as a box and whisper plot.

Table 3: Average conversational volatility for student meetings

	Meeting 1 (19)	Meeting 2 (19)	Meeting 3 (19)	Meeting 4 (16)
Average m-CV	7.113	8.478	7.905	5.531

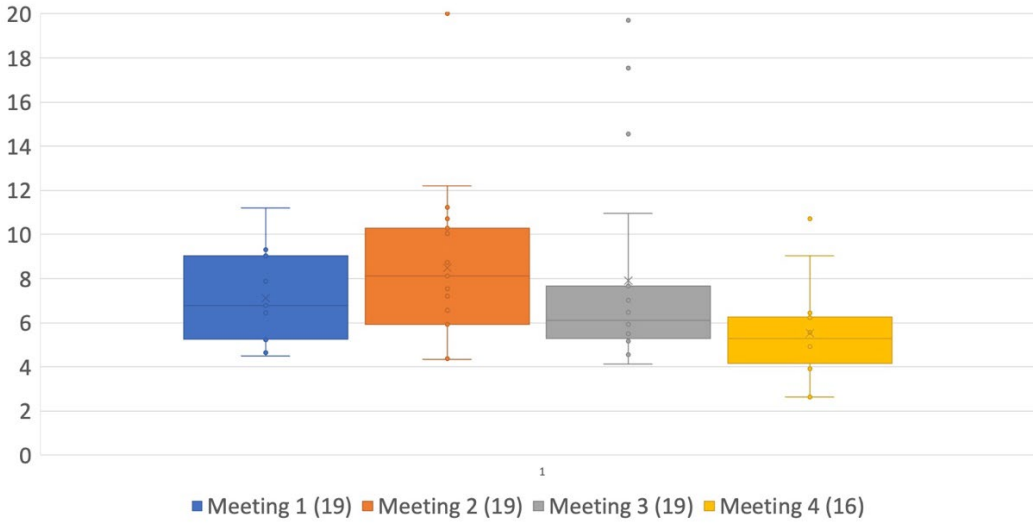

Figure 3: Distribution of m-CV values for first, second, third and fourth meetings for all students, y-axis shows conversational volatility value. Numbers in parentheses show the number of such meetings, 19 students had a first meeting, 16 students had a fourth meeting

What we see from Table 3 and from Figure 3 is that the average meeting CV values across the meetings decreased, which is surprising. We expected the online meetings to become more interactive as students got to know each other given that the first time they would have met would have been at their first meetings, and this did not happen. This makes us wonder about the nature of those meetings so we calculated individual conversational volatility (i-CV) values for each of the 86 meetings our 19 students took part in. The average i-CV for the meetings was 3.967 so the absolute values of i-CV compared to m-CV are much less but this does not matter since when computing m-CV across a group of participants in a meeting this is more likely to see short utterances and interruptions which can come from any participant and thus increase the level of volatility measure compared to contributions from a single individual.

We are interested in how the i-CV values change as meetings progressed from first to last and whether those i-CVs values increased, decreased or stayed the same. To examine this, for each student we calculated the slope of the linear regression line through their i-CV values for all that student's meetings. This is formally defined as

$$b = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sum (x-\bar{x})^2}$$

and its interpretation is illustrated in Figure 4 where we see two sample sets of data with slopes of +1.0 and -1.0 respectively.

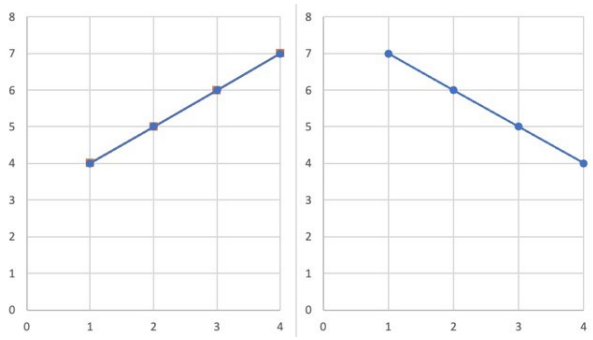

Figure 4: Sample calculations of slope with x- and y-axes showing sample values. Chart on the right has a slope = +1.0, chart on the left has a slope = -1.0

The distribution of slope values for the individual conversational volatility measures (i-CV) for our student cohort is shown as a box and whisper plot in Figure 5. This shows that the average slopes for entire meetings were positive (0.430) though for the French-speaking half of the meetings was negative (-0.471) and for the English-speaking half was slightly positive (0.126). The summary interpretation of this is that individual student engagement in their online tandem telecollaboration meetings did get more interactive as meetings progressed on average for meetings as a whole though less so for the French-speaking parts of their online meetings. However there were large differences in how some students engaged more and others less as their meetings progressed, as shown in Figure 5.

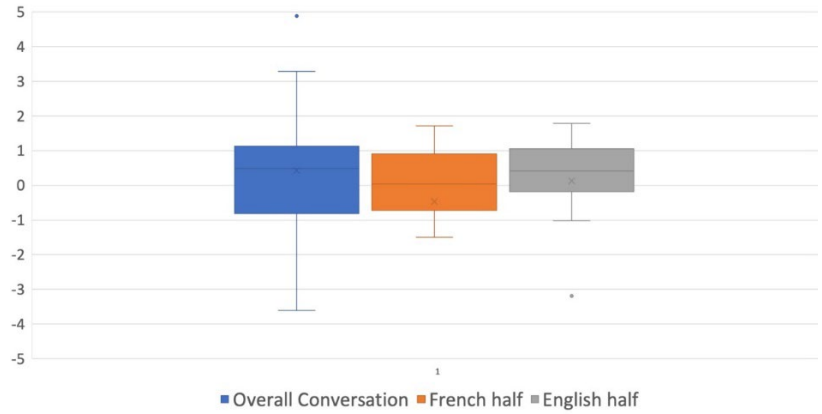

Figure 5: Distributions of slope values shown on y-axis for individual conversational volatility for entire meetings, for the first half of meetings (held in French) and for the second half of meetings (held in English)

5. Conclusions

In this paper we have presented an analysis of the results of automatically computing measures of students' levels of conversational interaction with fellow students in tandem collaboration as part of learning a second language. These measures were shared with students on an online dashboard during the semester though we are unsure what was the effect of having this information. Our analysis shows that students varied considerably in how their individual levels of engagement changed as their telecollaboration meetings progressed. Some students got more and more involved in the dialogue from one meeting to the next while others did not change their interaction levels at all, or became less engaged.

The reasons for this are not clear from the data we have and point to a need for further investigation into the nature of the meetings. Given that tandem telecollaboration is part of student-led autonomous learning we are unwilling to introduce closer monitoring of the meetings by lecturers so we take the approach of helping students to monitor their own interactions as part of their learning via the L2 Learning system and its dashboard.

However we are conscious that the choice of topics for discussion during the meetings where those topics were assigned to students, may have been either too difficult for some lower intermediate students or perhaps just not interesting enough for them. This may have influenced their engagement in some way, forcing them to be less engaged if they were not well versed or familiar with the discussion topic. For future usage of the L2 Learning system we will make more careful choices of discussion topics and perhaps make them student-led.

Acknowledgements

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Student participants have given informed consent for us to use their data, as approved by our institution's research ethics board with reference DCU REC2021_205.

References

Anscombe, F.J., (1973) Graphs in statistical analysis. *The American Statistician*, *27*(1), pp.17-21.

Chafe, W., & Tannen, D. (1987) "The Relation between Written and Spoken Language". *Annual Review of Anthropology*, *16*, 383–407. http://www.jstor.org/stable/2155877

Dey-Plissonneau, A., Lee, H., Pradier, V., Scriney, M. & Smeaton, A.F. (2021) "The L2L system for second language learning using visualised Zoom calls among students". *European Conference on Technology Enhanced Learning* (pp. 409-413). Springer, Cham.

Dey-Plissonneau, A., Lee, H., Scriney, M., Smeaton, A.F., Pradier, V. and Riaz, H., (2021) "Facilitating reflection in teletandem through automatically generated conversation metrics and playback video". *CALL and professionalisation: short papers from EUROCALL 2021*, p.88.

Dey-Plissonneau, A., Lee, H., Liu, M., Patel, V., Scriney, M. and Smeaton, A.F., (2022) "An Analysis of Conversational Volatility During Telecollaboration Sessions for Second Language Learning". *8th International Conference on Higher Education Advances (HEAd'2022)*, June 14 – 17, 2022, Valencia, Spain.

Ederington, L.H. and Guan, W. (2006) "Measuring historical volatility". *Journal of Applied Finance*, *16*(1).

Edlund, J., Heldner, M., Al Moubayed, S., Gravano, A. and Hirschberg, J. (2010) "Very short utterances in conversation". *Working papers/Lund University, Department of Linguistics and Phonetics*, *54*, pp.11-16.

Ishi, C.T., Ishiguro, H. and Hagita, N. (2014) "Analysis of relationship between head motion events and speech in dialogue conversations". *Speech Communication*, *57*, pp.233-243.

Lee, H., Liu, M., Riaz, H., Rajasekaren, N., Scriney, M. and Smeaton, A.F. (2021) "Attention based video summaries of live online Zoom classes". Presented at *AAAI-2021 Workshop on AI Education: "Imagining Post-COVID Education with AI" (TIPCE-2021)*.

Li, Y., Fang, A.C. and Cao, J. (2014) "A Quantitative View of Short Utterances in Daily Conversation: A Case Study of That's right, That's true and That's correct". In *Proceedings of the 28th Pacific Asia Conference on Language, Information and Computing* (pp. 378-386).

Lowe, R., Pow, N., Serban, I. and Pineau, J. (2015) "The ubuntu dialogue corpus: A large dataset for research in unstructured multi-turn dialogue systems". *arXiv preprint arXiv:1506.08909*.

O'Dowd, R. (2018) "From telecollaboration to virtual exchange: State-of-the-art and the role of UNICollaboration in moving forward". *Research-publishing. net*, *1*, pp.1-23.

Traum, D.R. and Heeman, P.A. (1996) "Utterance units in spoken dialogue". In *Workshop on Dialogue Processing in Spoken Language Systems* (pp. 125-140). Springer, Berlin, Heidelberg.

Wang, Y. and Wang, W.Y.C. (2019) "Fostering foreign language learning through a telecollaborative social media-based tandem language learning approach". In *International Workshop on Learning Technology for Education in Cloud* (pp. 362-368). Springer, Cham.

The Benefits and Disadvantages of e-Learning During Covid-19

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Abstract: The theme of the research is topical, there are changes in the e-learning during Covid-19 which changes set new tasks in the study process at the universities, as well as new communication links and the changes of the culture of pedagogical technologies. The aim of the research is to define the benefits and disadvantages of the e-learning in the study process at the universities and their correspondence with the needs of the students and academic staff during Covid-19. There are the following tasks to achieve the aim: to specify the functions of the meaning of the e-learning based on the changes in the e-environment during Covid-19; to investigate the adequacy of the contents of the university studies with the demand of e-learning nowadays; to find out the pedagogical instruments in the cognitive process which functions as a pedagogical form of the professional development and manifests itself in the benefits and disadvantages to the university education in the e-environment. In order to define the benefits and disadvantages of e-learning of the university education the authors take into account the theories of the science of pedagogy and education management. The following methods are used in the paper: abstract analysis, content analysis, systems analysis, interviews, surveys, questionnaires, economic experiment. The base of the research is the Universities of Latvia. The research is done in the period of 2019-2022.

Keywords: e-learning, Covid-19, e-environment, university, academic staff, students

1. Introduction

This is the first research on the analysis of factors influencing university studies in the e-learning and e-environment integration process by making use of Covid-19 factors, benefits and disadvantages of the e-learning development have been revealed.

Academic years 2018/2019 - 2021/2022 has been a challenge for representatives of many professions, including lecturers, and the challenges keep influencing the professional activities of lecturers and cooperation with students. In social networks, negative conclusions about the harm of restrictions on the activities and well-being of lecturers prevail. However, the daily issue is and remains as follows: how to replace the regular classes with a different type of lesson structure? This shift is dictated by restrictions introduced in Latvia; moreover, lecturers must react immediately, without methodical support and recommendations. In a crisis situation, educators are forced to use various forms of study organization as alternatives. The main problem is the principle of substitution and its connection with the goal of professional activity pursued by lecturers.

Can a lecturer achieve the goal and tasks set by himself or herself and provided for in the study programme using changing components of the study process? How do the changing circumstances and environment affect students and their choice to attend classes?

2. Background

2.1 Learning and teaching

In the Latvian national research programme CovidLife, 349 lectures of Latvian higher education establishments (HEE) and colleges were surveyed. The main conclusion was: “In Covid-19, the need is the best teacher” (Valsts pētījumu programma CoviDzīve, 2021). We fully agree with the lecturers’ opinion that a lecturer working in higher education must learn continuously, and at this stage of remote studies they have increased their skills at a turbo pace. However, in the near and distant future, care must be taken to ensure that pedagogical goals and student learning are a firm No 1 in the study process, because technologies become effective only when the lecturer knows how to use them well and is able to evaluate where they are not needed.

However, it should not be forgotten that the process is mutual – there is learning and teaching. “Teaching” is more often referred to the competence of the lecturer to organize, manage, and evaluate the study process. In

turn, "learning" refers to a practical activity carried out by students for the acquisition of knowledge, skills, and attitudes, which is particularly painful during this crisis. Therefore, higher education institutions should therefore be able to organise full-time and part-time studies, provide flexible forms of study, combined learning, and distance learning to respond to the needs of different groups of students, which, from a pedagogical point of view, strengthens combined learning (European Higher Education Area, 2020).

This can be achieved by creating a supportive environment, both in terms of funding and regulation, that enables higher education institutions to tailor education provision to the needs of different types of learners (lifelong learners, part-time learners, learners from underrepresented and disadvantaged groups), and to build a culture of equity and inclusion.

It is essential to promote continuous professional development (cross-border) and exchange of good practices among lecturers as well as to explore ways to promote new and innovative study methods, with a particular focus on inter-and multidisciplinary approaches, a research-based "teaching and learning" process.

2.2 Comparative analysis of videoconferencing software for online studies

Coronavirus has contributed significantly to the demand for videoconferencing software designed for remote studies and work. For example, since December 2019, the number of users of videoconferencing apps *Zoom* has increased 20 times. Thus, at the moment, in many countries *Zoom* is the market leader in the field of videoconferencing software for remote studies and work. One of the competitors, *Google Meet*, boasts a 30-time increase in the number of the software downloads in the US. According to the data provided by the service App Annie, during the same period, downloads of the *Microsoft Teams* app (with video call support) increased 11 times in the United States market, 30 times in Italy, and 15 times in Spain (currenttime.tv, 2022)

Since *Zoom* and *Microsoft Teams* stand out among the most popular software for organization of remote learning and work, we were curious to compare these direct competitors and identify the advantages and disadvantages of each of them.

For greater objectivity, it is worthwhile to define certain criteria and verify them for each of the software. It would be important to dwell on the system requirements, the supporting functions in the use of various equipment, the existing operating restrictions, the comfort of use, stability, connection quality, and software functionality (ms-teams.ru, 2022).

- System requirements: According to the official information, the system requirements of *Zoom* are slightly lower relative to *Microsoft Teams.* Namely, the *Zoom* software can work on a computer with a single-core processor with a frequency of 1 GHz against a dual-core processor with a frequency of 1.6 GHz in *Microsoft Teams*; *Zoom* does not have minimum screen resolution requirements; *Zoom* takes up slightly less disk space (ms-teams.ru, 2022; explore.zoom.us, 2022).
- Availability: Everything is quite simple here: both software support Windows, Mac OS and Linux operating systems as well as Android and iOS mobile platforms. The latest versions of the apps can be downloaded for free from the official website while the app for smartphones and tablets can be downloaded from the Google Play Store and the App Store (microsoft.com, 2022; zoom.us, 2022).
- Free version restrictions: In this aspect, *Microsoft Teams* has an advantage. Namely, a free *Zoom* account has a 40-minutes limit on the maximum duration of the video conference, and then the session ends (versus.com, 2022). This is a very significant fact because *Microsoft Teams* has no such restrictions.
- Ease of use: Installing and configuring both apps is equally simple but the registration process in *Microsoft Teams* is somewhat more complicated. It can even scare off new users, which is clearly a drawback. All the other features and buttons are easy to find, so it is quite difficult to get confused, for example, with the launch of your conference on both apps. However, the advantage in this category should go to the *Zoom* app.
- *Stability:* The *Zoom* app was first presented to the public in 2013 (zoom.us, 2022). Over these years, the developers have done a great job eliminating most of the errors and making its use as comfortable as possible. Deviations still occur, but not so often. The *Microsoft Teams* software was released in 2016 (microsoft.com, 2022), and even an outstanding developer could not avoid the unforeseen errors that users

often observe. This is especially true for the type of account login, switching between login accounts, registration, etc. In terms of stability, the *Zoom* app is definitely the best.

- Video and sound quality: Both *Zoom* and *Microsoft Teams* apps are not too demanding on the web speed and demonstrate good video and sound quality even at a slow web speed (adjusts automatically). It can be affected only by the stability on the user's part. According to these indicators, it is difficult to give preference to any of the programs, but there is one important nuance. In *Zoom* settings, the HD video (720p resolution) is disabled by default but it can be turned on manually. Meanwhile, in the *Microsoft Teams* app it is impossible. In addition, the *Zoom* app has an option to switch to FHD (1080p resolution) where an expensive paid web plan is used.
- Availability of useful functions: In this aspect, both software are almost identical. Both *Zoom* and *Microsoft Teams* offer: (a) good-quality online conferencing with video capability; (b) screen sharing, including with sound, for example to show presentations, videos, or other materials; (c) background change for participants; (d) recording conference progress so that a video file can be watched later; (e) creating a convenient structure (hierarchy) for employees.

So, based on the results of direct comparison of *Zoom* and *Microsoft Teams,* we have come to a conclusion that *Zoom* looks a little better due to lower system requirements, stability, and ease of use. The main disadvantage of the *Zoom* program is the limitation of the conference duration for a free account (40 minutes).

In turn, the *Cisco Webex Meetings* is a webinar and conference software developed by *Cisco* for its own purposes and offered to other companies. The software also has a free version that can be used to hold small remote events (webex.com, 2022; habr.com, 2022).

3. Methodology

Each of the experts was asked to describe his or her work experience as a lecturer at the HEE in general and during Covid-19 (a/y 2018/2019–2021/2022) according to seven criteria: (1) scientific degree and academic position in higher education institution; (2) work experience as a lecturer in higher education institution; (3) bachelor's courses delivered by the expert; (4) master's courses delivered by the expert; (5) doctoral courses delivered by the expert; (6) supervision of term papers, internship papers and final thesis; (7) participation in the work of term paper, internship paper and final thesis defence committees. The above characteristics of experts is summarized in Table 1. It follows that all experts are competent enough to qualify as such. Therefore, experts can participate in the study on the advantages and disadvantages of e-study in higher education institutions in Latvia during Covid-19.

Summary of the expert information about the software used in the e-study environment and technical support of the HEE shows that the first expert works with *Zoom*, the second expert – with *MS Teams*, and the third expert – with *Cisco Webex*. Technical support provided to all experts was similar. Namely, it was an electronically prepared instruction for work with the selected software, available on the website of the HEE, in the section available to academic staff and students. Lecturers could access all technical consultations only remotely, as face-to-face meetings were prohibited during Covid-19. This caused some stress first, because during the classes lecturers were forced to focus more on the technical nuances and less on the content of the lessons.

From 9 to 23 May 2022, a survey of experts was conducted. Three experts with long-term academic experience in various HEE of Latvia and a doctoral degree in economics participated in the survey. The survey covered the remote work of lecturers of social science study programs during Covid-19. The main focus was on the lecturer's work in the study programs of economics, management, tourism, and education management. The experts were interviewed electronically via e-mail. Therefore, each expert could express his or her opinion without affecting

For this purpose, we improved a survey form that was designed by our second author Sarmite Jegere and approbated already before. It includes three tables with six statements. Statements in table 2 concern bachelor's studies, statements in table 3 regard master's studies, and statements in table 4 refer to doctoral studies. Each table contains the same six statements.

In addition, each of the experts was asked to name in the order of priority three advantages and three disadvantages of the e-study environment during Covid-19 at the HEE he or she works for and briefly comment on the advantages and disadvantages.

Table 1: The characteristics of experts and his or her work experience as a lecturer at the HEE during Covid-19

No	Criteria for expert evaluation	Expert No 1 (E1)	Expert No 2 (E2)	Expert No 3 (E3)
1	Scientific degree and academic position at the higher education establishment in 2022	Dr.oec., Professor	Dr.oec., Professor	Dr.oec., Associate Professor
2	Work experience as a lecturer at the higher education establishment till 2022	26 years	32 years	16 years
3	Bachelor's courses delivered by the lecturer in period 2018-2022 per academic year (average)	2 study courses (12 ECTS)	7 study courses (22,5 ECTS)	5 study courses (30 ECTS)
4	Master's courses delivered by the lecturer in period 2018-2022 per academic year (average)	1 study course (3 ECTS)	2 study courses (6 ECTS)	1 study course (4,5 ECTS)
5	Doctoral courses delivered by the lecturer in period 2018-2022 per academic year (average)	3 study corses (24 ECTS)	None	None
6	Supervision of term papers, intership papers and final thesis in period 2018 -2022 per academic year (average)	5 intership papers, 8 final thesis	2 intership papers, 3 final thesis	100 term papers, 100 intership papers, 55 final thesis
7	Participation in the work of term papers, intership papers and final thesis defence commitees in period 2018-2022 per academic year (average)	1 final thesis defence commitee	None	2 term papers, 2 intership papers, 6 final thesis defence commitees

4. Results

According to the results of the expert survey summarised in table 2, in the remotely implemented bachelor's courses, one expert partially agrees with statements B1 and B4 and two experts agree with both statements. Thus, it leads to a conclusion that lecturers can deliver bachelor's lectures, seminars, and workshops remotely with 90 %–100 % return, but in some cases with near 90 % return. In contrast, two experts agree partially and one expert agrees with statements B3, B5, and B6. It follows that students technically connect to remote bachelor's lectures, seminars, and workshops. However, periodically or regularly, some of the bachelor's students do not engage in communication with the lecturer during the lesson. In addition, it can be concluded that in remote workshops the lecturer can only partially or cannot fully implement an individual approach to each bachelor's student. When comparing expert ratings on statement B2, each expert has his or her own different rating. This means that each lecturer has different technical provision of the Internet.

According to the results presented in expert survey table 3, all experts agree with statement M1 and statement M4 in relation to the remotely delivered master's courses. It brings to conclusion that lecturers can deliver master's lectures, seminars, and workshops remotely with 90 %–100 % return. In contrast, two experts agree partially, and one expert agrees with statements M3 and M5. It follows that students technically connect to remote master's lectures, seminars, and workshops. However, periodically some of the master's students do not engage in communication with the lecturer during the lesson. Nevertheless, one expert admits that all master's students engage in communication with the lecturer during the lesson. Whereas two experts agree partially, and one expert agrees with statement M6. Thus, it can be concluded that in remote workshops the lecturer can only partially or cannot fully implement an individual approach to each master's student. When comparing expert ratings on statement M2, each expert has his or her own different rating. This means that each lecturer has different technical provision of the Internet.

Table 2: The results of the expert's survey about bachelor's online classes during Covid-19

No	Statements about bachelors' online classes	Disagree	Partially agree	Agree
B1	I can deliver lectures online with 90 %–100 % return		E2	E1; E3
B2	Web coverage problems prevent me from a successful delivery of online lectures	E3	E1	E2
B3	When delivering lectures online I observe that students connect but do not actually participate (engage themselves in side issues)		E1; E3	E2
B4	I can deliver seminars and workshops with 90 %–100 % return		E2	E1; E3
B5	I fail to involve the whole group in seminars and workshops		E1; E3	E2
B6	In workshops, an individual approach to each student is limited		E1; E3	E2

Table 3: The results of the expert's survey about master's online classes during Covid-19

No	Statements about masters' online classes	Disagree	Partially agree	Agree
M1	I can deliver lectures online with 90 %–100 % return			E1; E2; E3
M2	Web coverage problems prevent me from a successful delivery of online lectures	E3	E1	E2
M3	When delivering lectures online I observe that students connect but do not actually participate (engage themselves in side issues)	E3	E1; E2	
M4	I can deliver seminars and workshops with 90 %–100 % return			E1; E2; E3
M5	I fail to involve the whole group in seminars and workshops	E3	E1; E2	
M6	In workshops, an individual approach to each student is limited		E1; E3	E2

Table 4: The results of the expert survey about doctoral students' online classes during Covid-19

No	Statements about doctoral students' online classes	Disagree	Partially agree	Agree
D1	I can deliver lectures online with 90 %–100 % return			E1
D2	Web coverage problems prevent me from a successful delivery of online lectures		E1	
D3	When delivering lectures online I observe that students connect but do not actually participate (engage themselves in side issues)	E1		
D4	I can deliver seminars and workshops with 90 %–100 % return			E1
D5	I fail to involve the whole group in seminars and workshops	E1		
D6	In workshops, an individual approach to each student is limited	E1		

According to the results presented in expert survey table 4, only one expert has delivered doctoral courses remotely but the other two experts do not have such work experience. The sole expert agrees with statement D1 and statement D4. It brings to a conclusion that the lecturer can deliver doctoral lectures, seminars, and workshops remotely with 90 %–100 % return. Whereas, the sole expert does not agree with statements D3, D5, and D6. It follows that students both technically connect to remote doctoral lectures, seminars, and workshops as well as engage in communication with the lecturer during the lesson. In addition, it can be concluded that in remote workshops, the lecturer can implement an individual approach to each doctoral student. The sole expert

agrees with statement D2 partially thus recognizing that successful lecturing online is partially hampered by the Internet coverage problems.

The advantages of lecturer's work in an e-study environment during Covid-19 defined by experts are summarized in table 5. It shows that all experts mention the saving of time on the way to and from the higher education institution as the first advantage of the lecturer's work in the e-study environment. In turn, when defining the second advantage, the opinions of experts differ. The second advantage of work in the e-study environment mentioned by the first expert is as follows: the software provides automatic registration of the lesson participants and a detailed report hereof. The second advantage named by the second expert is the cost savings associated with travel, accommodation, eating out of the house, gifts for the family, and the purchase of new costumes necessary for lecture delivering. The third expert says that the second advantage is the software-provided opportunities for using various digital tools to work with students. The opinions of experts also differ regarding the third advantage of the lecturer's work in the e-study environment. The first expert considers that the third advantage is the savings on the lecturer's clothes, shoes, and accessories when working in the e-study environment. The second expert defines that the third advantage lays in the fact that the software allows students to record and listen to online lessons at a time which is the most convenient to them. The third advantage named by the third expert is as follows: the software allows students to use online tests in test works and get an instant test result.

Table 5: The advantages of lecturer's work in the e-study environment during Covid-19 defined by experts in priority order

No	The adventages defined by the expert No 1	The adventages defined by the expert No 2	The adventages defined by the expert No 3
1st	The saving of time on the way to and from the HEE.	The saving of time on the way to and from the HEE.	The saving of time on the way to and from the HEE.
2nd	The software provides automatic registration of the lesson participants and a detailed report hereof.	The cost savings associated with travel, accommodation, eating out of the house, gifts for the family, and the purchase of new costumes necessary for lecture delivering.	The software-provided opportunities for using various digital tools to work with students.
3rd	The savings on the lecturer’s clothes, shoes, and accessories when working in the e-study environment.	The software allows students to record and listen to online lessons at a time which is the most convenient to them.	The software allows students to use online tests in test works and get an instant test result.

The disadvantages of lecturer's work in an e-study environment during Covid-19 defined by experts are summarized in table 6. According to the first expert, the first disadvantage of the lecturer's work in the e-study environment is the insufficient technical support for the lecturer's work in the e-study environment in the home environment because of lack of a specific device or incompatibility of devices. In turn, the second and third experts point out that the first disadvantage is as follows: in the e-study environment, it is much more challenging to involve students in discussions, to observe the reaction and feedback of students, to draw conclusions about whether the content of the lesson has been mastered. In particular, there is a lack of direct communication in the e-study environment, which helps to open students up for cooperation. Whereas, as the second disadvantage of the lecturer's work in the e-study environment, the first expert names the lack of sufficiently stable web coverage for work in the e-study environment. This problem becomes extremely acute where several residents of the house have to work or study from home at the same time. Speaking of the second disadvantage of the lecturer's work in the e-study environment, the second expert refers to the fact that during the computer presentation it is technically complicated or even impossible to use other documents in other formats or voluminous materials. The third expert says that the second disadvantage of the lecturer's work in the e-study environment is the difficulty to maintain the attention of all students while one student gives his or her answer or expresses his or her opinion. The first expert continues the analysis of the flaws of the lecturer's work in the e-study environment and names the lack of sufficiently stable provision of premises for the lecturer's work in the e-study environment from home as the third disadvantage. This problem becomes extremely acute where several residents of the house have to work or study from home at the same time. The second expert mentions that the third disadvantage of the lecturer's work in the e-study environment is as follows: during the lessons

the lecturer cannot move, shift, and brighten up essential thoughts with the help of gestures, mimicry, and other movements. Namely, the lecturer can basically use only the voice, which reduces the overall impression and the lessons become less effective. In turn, the third expert defines that the third disadvantage of teaching in the e-study environment is the difficulty to make students to have their cameras on throughout the lesson.

Table 6: The disadvantages of lecturer's work in the e-study environment during Covid-19 defined by experts in priority order

No	The disadvantages defined by the expert No 1	The disadvantages defined by the expert No 2	The disadvantages defined by the expert No 3
1st	The insufficient technical support for the lecturer's work in the e-study environment in the home environment because of lack of a specific device or incompatibility of devices.	In the e-study environment, it is much more challenging to involve students in discussions, to observe the reaction and feedback of students, to draw conclusions about whether the content of the lesson has been mastered.	In the e-study environment, it is much more challenging to involve students in discussions, to observe the reaction and feedback of students, to draw conclusions about whether the content of the lesson has been mastered. In particular, there is a lack of direct communication in the e-study environment, which helps to open students up for cooperation.
2nd	The lack of sufficiently stable web coverage for work in the e-study environment. This problem becomes extremely acute where several residents of the house have to work or study from home at the same time.	The fact that during the computer presentation it is technically complicated or even impossible to use other documents in other formats or voluminous materials.	The difficulty to maintain the attention of all students while one student gives his or her answer or expresses his or her opinion.
3rd	The lack of sufficiently stable provision of premises for the lecturer's work in the e-study environment from home. This problem becomes extremely acute where several residents of the house have to work or study from home at the same time.	During the lessons the lecturer cannot move, shift, and brighten up essential thoughts with the help of gestures, mimicry, and other movements. Namely, the lecturer can basically use only the voice, which reduces the overall impression and the lessons become less effective.	The difficulty to make students to have their cameras on throughout the lesson.

5. Conclusions

Summary of experts' statements provided in all the three tables leads to the following conclusions: (1) the higher the study level, the higher the return of seminars and workshops delivered by the lecturers in the online environment; (2) the higher the study level, the better lecturers can engage students in mutual communication during lectures, seminars, and workshops delivered in the online environment; (3) the higher the study level, the better lecturers can ensure an individual approach to every student in workshops delivered in the online environment; and, (4) the higher the study level, the less lecturers are disrupted during online lectures by the Internet coverage problems.

Summary of the results of expert surveys on the lecturer's work in the e-study environment during Covid-19 brings to several conclusions: (1) lecturers in higher education institutions can implement studies in the e-study environment without experiencing significant problems; (2) the main advantages of the lecturer's work in the e-study environment are time and cost savings related to the moving to and from the higher education institution as well as the software-provided opportunity to register the lesson participants, check tests online and record online lessons; (3) the main disadvantages of the lecturer's work in the e-study environment are the insufficient technical provision and availability of premises, unstable web coverage while working from home as well as the difficulties to provide a stable communication with students and effective, diverse course of lessons.

References

European Higher Education Area. (2020). Annex II to the Rome Ministerial Communiqué: Principles and Guidelines to Strengthen the Social Dimension of Higher Education in the EHEA. Pieejams: http://ehea.info/Upload/Rome_Ministerial_Communique_Annex_II.pdf {Accessed on 11/05/2022}

https://explore.zoom.us/ru/zoom-vs-microsoft-teams/ {Accessed on 03/05/2022}.

https://habr.com/ru/company/leader-id/blog/496094/ {Accessed on 23/05/2022}.

https://www.microsoft.com/lv-lv/microsoft-teams/group-chat-software {Accessed on 05/05/2022}

https://ms-teams.ru/faq/microsoft-teams-or-zoom {Accessed on 06/05/2022}

https://versus.com/ru/microsoft-teams-vs-zoom-cloud-meetings {Accessed on 09/05/2022}

https://www.currenttime.tv/a/video-conference-apps-covid19/30534330.html {Accessed on 10/05/2022}

https://www.webex.com/video-conferencing {Accessed on 24/05/2022}

https://zoom.us {Accessed on 02/05/2022}

Valsts pētījuma programma CoviDzīve (2021) Akadēmiskā personāla pedagoģiski digitālās kompetences pašizvērtējums un pilnveides piedāvājums. Pieejams: https://lzp.gov.lv/wpcontent/uploads/2021/02/35_lidz_38_zinojumi_pielik_03_rez_37_38_c.pdf {Accessed on 12/05/2022}

What Previous Research Says About Virtual and Augmented Reality in Higher Education

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Abstract: Virtual reality is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings. It is not a recent technology, nor is its application to education. Despite its popularity, it is not widely used in education because of its limitations including required technologies, the cost and etc. In order to gain a better understanding of how it is used in higher education so far and what the trends regarding courses and teaching methods in which virtual and augmented realities are integrated are, it is thought that it may be helpful to conduct a systematic review of the use of virtual reality in higher education. This paper aims at contributing to an understanding of using virtual reality in higher education in the context of technology enhanced learning. So, it is designed as a systematic literature review with five steps. Those steps are description of research questions, searching for relevant published research, screening of those research, coding of them, and lastly analysing and mapping the data. Based on the data, it can be said that virtual and augmented realities in higher education have been mostly implemented in the medicine courses and simulations have been mostly implemented in virtual and augmented realities in higher education as teaching strategies.

Keywords: virtual reality, augmented reality, higher education, systematic review

1. Introduction

Virtual reality is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings. It is not a recent technology, nor is its application to education. When the studies on the advantages of VR and AR are examined, it can be said that VR-based content helped students better understand the subject matter and allowed the instructor to design the course without the need for costly laboratory upgrades (Syed et al., 2019). In terms of motivation and engagement, AR-based learning modes may attract and motivate learners to learn (Chu et al., 2019) and boosts their confidence (Al-Hatem, 2018). Last but not least, several advanced tools for ICT-supported pedagogical practices, such as gamification and the use of virtual and mixed reality, as well as social media, can help university students develop collaborative skills online (Martinez, 2018).

Despite its popularity, it is not widely used in education because of its limitations including required technologies, the cost and etc. In order to gain a better understanding of how it is used in higher education so far and what the trends regarding courses and teaching strategies in which virtual and augmented realities are integrated are, it is thought that it may be helpful to conduct a systematic review of the use of virtual and augmented realities in higher education.

This paper aims at contributing to an understanding of using virtual and augmented realities in higher education in the context of technology enhanced learning. To accomplish this, the current study began with the formulation of research questions. The following are the study's research questions:

- 1. What are the trends in publications related to virtual and augmented realities in higher education, including courses and teaching strategies in which virtual and augmented realities are integrated?
- 2. What are the difficulties experienced in the integration of virtual and augmented realities in publications related to virtual and augmented realities in higher education?

2. Method

This study is designed as a systematic literature review with five steps. Those steps according to Petersen et al. (2008) are description of research questions, searching for relevant published research, screening of those research, coding of them, and lastly analysing and mapping the data. Gusenbauer and Haddaway (2020) conducted a recent review in which they evaluated the retrieval performance of 28 well-known databases for evidence synthesis and concluded that, some databases, such as Google Scholar, are useful for cross-checks,

while they are not suitable for reviews. For this reason, Web of Science database was selected among the principal sources they listed. The study was framed with articles in English published in the last 5 years. After an advanced search, it was seen that there were 70 studies, but since 6 of them could not be reached and 4 of them have only abstract in English, the study has been carried out with 60 studies. After screening the related research, it has been seen that 57 of them are relevant for that review.

3. Findings

3.1 RQ1

After screening relevant published research, we wanted to see how articles are distributed based on the research methods in order to weigh in on the experimental design and reveal the courses which virtual and augmented realities are integrated.

Table 1: The distribution of research methods in relevant published research

Research Methods	Frequency
Theoretical Studies	9
Survey Studies	10
Experimental Studies	31
Qualitative Methods	2
Systematic Reviews	5

Based on the information presented in the Table 1, it can be said that experimental studies have been most frequently used in virtual and augmented realities research in higher education. The shorting of the research methods follows experimental researches (31) as survey studies (10), theoretical studies (9), systematic reviews (5), and qualitative methods (2). After mapping the research methods in relevant published research, we wanted to see if there is a distribution of the courses the studies conducted in experimental studies. For this reason, for that part, we focused on experimental studies (n=31).

Table 2: The distribution of the courses the studies conducted in relevant published research

Courses	Frequency
Teacher Education	4
Medicine	9
Engineering	8
Tourism	3
Business	2
Social Sciences	5

After screening process, it can be seen that there is a distribution of course in virtual and augmented realities research in higher education. Based on the information relevant published research provided (Table 2), it can be said that virtual and augmented realities in higher education have been mostly implemented in the medicine courses. Those courses consist of medicine, surgery and nursing subjects. The shorting of the courses the study conducted follows medicine (9) as engineering (8), social sciences (5), teacher education (4), tourism (3) and business (2).

After mapping the courses studies conducted in relevant published research, we wanted to see if there is a distribution of the teaching strategies in virtual and augmented realities research in higher education in experimental studies (n=31).

Table 3: The distribution of teaching strategies in relevant published research

Teaching Strategies	Frequency
Simulation (Scenario-based learning)	11
Digital learning environment	8
Field trips	4
Assessment	2
Classroom replica	2
Virtual lab	2
Drama	1
Library	1

After screening process, it can be seen that there is a distribution of teaching strategies in virtual and augmented realities research in higher education. Based on the information relevant published research provided (Table 3), it can be said that simulations have been mostly implemented in virtual and augmented realities research in higher education as a teaching strategy. The shorting of the teaching strategies follows simulations (11) as digital learning environment (8), field trips (4), assessment (2), classroom replica (2), virtual labs (2), drama (1), and library (1). Simulations are explained as a scenario-based learning in some researches and students were expected to complete some tasks based on the scenario. Besides that, virtual and augmented realities in higher education have been mostly used to create a virtual environment for students to access digital learning environments.

3.2 RQ2

Lastly, when we looked at the limitations of the relevant published studies, it can be said that there are a bunch of limitations of using virtual and augmented realities in higher education.

The first is that, as Kim et al. (2017) point out, the number of participants was small. Larger samples were required to draw a conclusion about successful use virtual and augmented realities in higher education.

Another limitation of use virtual and augmented realities in higher education was that the majority of the participants had never tried immersive VR or AR before; thus, the positive results favouring the immersive platforms could be due in part to the technology's novelty (Makransky & Lilleholt, 2018).

VR and AR are still a relatively new technologies, and some of the participants were unfamiliar with it (Alahmari et al., 2019), this situation makes it difficult for the researcher to obtain data from an exploratory source.

Another limitation of use virtual and augmented realities in higher education is availability and accessibility of the enabling technologies, and the supportive resources (Ip et al., 2019; Fransson et al., 2020). Sustainability, maintenance and outreach are very critical issues for the universities and they are also limitations of use virtual and augmented realities in higher education.

4. Discussion

Despite the popularity of virtual and augmented realities, they are not widely used in education because of their limitations including required technologies, the cost and etc. In order to gain a better understanding of how they were used in higher education so far and what the trends regarding courses and teaching strategies in which virtual and augmented realities were integrated were, it was thought that it may be helpful to conduct a systematic review of the use of virtual and augmented realities in higher education.

In this short paper, we tried to present trends on both the courses the studies conducted in relevant published research on virtual and augmented realities in higher education and teaching strategies on the use of virtual and augmented realities in higher education. Based on the findings, it can be said that virtual and augmented realities in higher education have been mostly implemented in the medicine courses. Those courses consist of medicine, surgery and nursing subjects. Medicine courses are followed by engineering and teacher education courses, respectively. Regarding the teaching strategies, it can be said that simulations have been mostly implemented in virtual and augmented realities research in higher education as a teaching strategy. The shorting of the teaching strategies follows simulations as digital learning environment, field trips, assessments and virtual labs.

In terms of interaction and collaborative learning, the teaching strategies used with virtual and augmented realities do not provide the interactive environment and opportunity for collaborative learning for students, contrary to expectations. Simulations have been mostly implemented in virtual and augmented realities research in higher education as a teaching strategy, but those simulations do not give any chance to students to interact with their peers, even though research shows that any increase in environment interactivity will increase user’s confidence (Al-Hatem et al., 2018).

Based on those findings, it can be recommended that virtual and augmented reality tools should be used carefully in higher education to give students more interactive learning environment and let them to work collaboratively, not just a new tool.

References

Al-Hatem, A. I., Masood, M., & Al-Samarraie, H. (2018). Fostering student nurses' self-regulated learning with the second life environment: An empirical study. *Journal of Information Technology Education: Research*, *17*(1), 285-307. Retrieved from, https://dx.doi.org/10.28945/4110

Alahmari, M., Issa, T., Issa, T., & Nau, S. Z. (2019). Faculty awareness of the economic and environmental benefits of augmented reality for sustainability in Saudi Arabian universities. *Journal of Cleaner Production, 226*, 259-269. Retrieved from, https://doi.org/10.1016/j.jclepro.2019.04.090

Chu, H. C., Chen, J. M., Hwang, G. J., & Chen, T. W. (2019). Effects of formative assessment in an augmented reality approach to conducting ubiquitous learning activities for architecture courses. *Universal Access in the Information Society*, *18*(2), 221-230. Retrieved from, https://doi.org/10.1007/s10209-017-0588-y

Fransson, G., Holmberg, J., & Westelius, C. (2020). The challenges of using head mounted virtual reality in K-12 schools from a teacher perspective. *Education and Information Technologies, 25*(4), 3383-3404. Retrieved from, https://doi.org/10.1007/s10639-020-10119-1

Gusenbauer, M., & Haddaway, N. R. (2020). Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google scholar, PubMed, and 26 other resources. *Research Synthesis Methods, 11*(2), 181–217. Retrieved from, https://doi.org/10.1002/jrsm.1378

Ip, H. H. S., Li, C., Leoni, S., Chen, Y., Ma, K. F., Wong, C. H. T., & Li, Q. (2018). Design and evaluate immersive learning experience for massive open online courses (MOOCs). *IEEE Transactions on Learning Technologies, 12*(4), 503-515. Retrieved from, https://doi.org/10.1109/TLT.2018.2878700

Kim, P. W., Shin, Y. S., Ha, B. H., & Anisetti, M. (2017). Effects of avatar character performances in virtual reality dramas used for teachers' education. *Behaviour & Information Technology, 36*(7), 699-712. Retrieved from, https://doi.org/10.1080/0144929X.2016.1275809

Makransky, G., & Lilleholt, L. (2018). A structural equation modelling investigation of the emotional value of immersive virtual reality in education. *Educational Technology Research and Development, 66*(5), 1141-1164. Retrieved from, https://doi.org/10.1007/s11423-018-9581-2

Martínez-Cerdá, J. F., Torrent-Sellens, J., & González-González, I. (2018). Promoting collaborative skills in online university: Comparing effects of games, mixed reality, social media, and other tools for ICT-supported pedagogical practices. *Behaviour & Information Technology*, *37*(10-11), 1055-1071. Retrieved from, https://doi.org/10.1080/0144929X.2018.1476919

Petersen, K., Feldt, R., Mujtaba, S., & Mattsson, M. (2008). Systematic mapping studies in software engineering. In 12th International Conference on Evaluation and Assessment in Software Engineering (EASE) 12 (pp. 1-10). Retrieved from, http://dl.acm.org/citation.cfm?id=2227115.2227123.

Syed, Z. A., Trabookis, Z., Bertrand, J., Chalil Madathil, K., Hartley, R. S., Frady, K. K., ... & Gramopadhye, A. K. (2019). Evaluation of virtual reality based learning materials as a supplement to the undergraduate mechanical engineering laboratory experience. *International Journal of Engineering Education*, *35*(3). Retrieved from, https://par.nsf.gov/biblio/10096489.

The Role of Mobile Technologies in the Development of Key Competencies:A Review Study

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Abstract: Modern education is based on the development of key competencies. By developing key competencies, we should prepare pupils and students for real life, i.e. for their beneficial integration into society and their professional life. At the same time, digital devices are penetrating education, of which mobile technologies have a strong position in education. Much research has looked at the impact of mobile technology on the learning process, motivation and learning fixation, but does this technology have an impact on the development of key competencies? These thoughts led the authors to produce a review study that maps the role of mobile technology in the development of key competencies. The paper aims to analyse the available literature and determine the current state of the art on the issue described above. In the theoretical part of the paper, the authors describe the theoretical background that formed the basis for the development of the review study. The theoretical part of the thesis deals with the area of mobile technologies in education, where the authors define the term mobile technologies and briefly outline their position in education. Another area discussed is key competencies, where the authors define the term, describe their role in the context of European education, and focus in detail on key competencies for learning, problem solving, communicative competencies, and digital competencies. The last theoretical area described is the the research methodology, in which the authors focus exclusively on defining the concept of a review study. The research part contains the methodology of the conducted research, where the specific procedure of the review study is described. 50 publications were selected and analysed in detail, and the information found was recorded in a table. The results of the research do not only contain conclusions about which key competencies are developed by mobile technologies but also look at, among other things, what level of education uses this technology or how different countries perceive this issue. The results of the research can serve as a basis for further research that can look at the relationship between mobile technology and specific key competencies.

Keywords: mobile technology, mobile learning, key competencies, overview study, education, review study

1. Introduction

Modern education aims to prepare people for their lives so that they can contribute to society. To achieve a sufficient level of this preparation, the development of selected key competencies is necessary, which include all relevant skills. The preparation of an individual for life takes place from pre-primary education, through primary education, secondary education, higher education, and the individual himself develops his key competencies independently throughout his life. Therefore, it is a lifelong process.

Mobile technology started to penetrate education in 2006. Currently, it is one of the most widely used technologies in education. In addition to mobile technologies (specifically tablets), these include computers, interactive whiteboards, and robotic toys. In a previous investigation, the authors found that mobile technologies have a positive effect on various aspects of learning, among which we can name motivation or fixation of learning in memory. Can mobile technologies be a suitable tool for developing key competencies? This question was the authors' initial idea to conduct the research.

The thesis is a review study on the described issue. The first part of the paper introduces the reader to the topic**,** with a special emphasis on the area of key competencies and mobile technologies in education. The second section describes the research methodology, the theoretical foundations in the field of review studies are defined and then the procedure for conducting the research is described. In the next section, the authors present the results obtained and interpret the data using graphical processing. The conclusion of the paper is devoted to a discussion of the findings and possibilities for further research.

1.1 Key competency

The concept of competence can be defined in many different ways. A basic definition understands competence as the practical application of knowledge and skills that an individual has learned during the educational process (Chvál and Straková, 2014). Another concept extends this definition to include the element of routine and habit (Klieme et al, 2010). The development of key competencies is the basis of

modern education. Key competencies can be defined as a set of knowledge, skills, abilities, attitudes and values important for the personal development and application of each member of society (Ministry of Education, Youth and Sports of the Czech Republic, 2021). The term key competencies can also be loosely translated as key skills, and basic skills, key qualifications. The development of key competencies is mainly seen in the countries of the European Union, but, as the survey below shows (Chapter 3.3), key competencies are also an important part of education in many countries outside the European Union. The European Union recommends that its member states develop eight basic key competencies (European Commission, Directorate-General for Education, Youth, Sport and Culture, 2019):

- Literacy competence;
- Multilingual competence;
- Mathematical competence and competence in science, technology and engineering;
- Digital competence;
- Personal, social, and learning-to-learning competence;
- Civic competence;
- Enterpreneurship competence;
- Cultural awareness and expression competence.

Based on these recommended key competencies, each EU member state has defined its own key competencies on which to focus their education. The authors of the research described here key competencies for learning, key competencies for problem solving, communicative key competencies and social and personal competencies. These competencies were chosen because the educational system in the Czech Republic emphasises the development of these competencies and therefore these competencies are the focus of the authors' interest (Ministry of Education, Youth and Sports of the Czech Republic, 2021).

1.2 Mobile technology in education

Mobile technology is a common part of the lives of individuals in modern society. Statistics show that in 2014, 1.57 billion users owned a smartphone, in 2017 it was 2.32 billion, and in 2020 the number of users reached 2.87 billion (Riadi et al, 2017). In 2021, 97% of Americans owned a mobile device, of which 85% owned a smartphone (Pew Research Center, 2021). In 2022, the number of users will reach 3 billion (IBM, 2022). The popularity of these devices has also translated to the education sector, where mobile technology is one of the most widely used digital tools. In addition, we can name, for example, computers and laptops, which are more numerous than mobile technologies.

Mobile technology refers to devices that do not rely on a permanent connection to the power grid and allow the user to easily manipulate the device. A mobile device consists of a two-way communication device, a computing device, and a network connection device (IBM, 2022). These devices can include smartphones, tablets, laptops, GPS navigation, etc. Tablets are widely used in education.

A mobile device can offer the user a wide range of sensors. These sensors include an accelerometer, gyroscope, compass, distance sensor, GPS, and others. In addition, the mobile device has many tools, which include a front and rear camera, microphone, speaker, internet connection, and touch screen. Many of these sensors and tools find application in education. Smartphones and tablets are based on the use of apps. There are currently a large number of apps (in the billions) on the market. Educational apps are a separate category.

1.3 Research problem

In previous research, the authors found that mobile technology has a positive effect on learning fixation. 44 students, aged 11 to 12, participated in the investigation. The authors compared the outcomes of a control group that received instruction in a traditional way and an experimental group that used mobile technology during instruction. From the comparison of the control and experimental groups, it was concluded that mobile technology had a positive effect on the fixation of new learning (Tran et al, 2019). In a further investigation of the issue at hand, the authors found that mobile technology also positively influenced student motivation and promoted an individual approach to learning (Gybas et al, 2017). Based on these findings, the question arises whether mobile technologies are a suitable tool for the development of key competencies that form the

fundamental pillar of modern education. As a first step to find the answer to this question, the authors conducted an extensive search of the international literature and produced a review study. The results of this study reflect the current state of the use of mobile devices in the development of key competencies.

2. Methodology

The second chapter of this paper describes the methodology of the survey. In the first part of this chapter, the authors describe the theoretical basis of the research methodology and define the chosen research method - a review study. The second part contains the real course of the conducted research.

2.1 Overview study

The term review study refers to a specific genre of research that maps the current state of the art in a given research area. The authors conducted a mapping review, which relies on a larger body of work on a given topic over a selected time period. The authors analyzed each research study and graphically illustrated the interpretation of the findings. Mareš recommends this procedure when preparing a review study (Mareš, 2013):

- 1. Choose a suitable topic for the review study;
- 2. Selecting the appropriate type of review study;
- 3. Conducting a literature search on the topic - creating a comprehensive inventory of works;
- 4. Analyzing basic data on each identified paper and narrowing the papers to only relevant studies;
- 5. Critical reading and detailed analysis of the shortlisted studies;
- 6. Compilation of data on all studies reviewed into a comparative table;
- 7. Identification of key characteristics of the selected topic;
- 8. Synthesis of the obtained characteristics of the selected topic into larger units;
- 9. Writing of the different parts of the review study;

The authors followed the procedure described above during the preparation of the review study. The following sub-chapters describe the process of each stage of the investigation.

2.1.1 Conducting a literature search

The initial literature search used the Scopus database, which was searched for publications based on several combinations of keywords. The table below presents the combinations of keywords used and the number of records found. A total of 1332 publications were retrieved in the initial search phase.

Table 1: Keyword combinations and number of records found

Keyword combination	Quantity of records found
communication competency tablet learning	16
communicative competency mobile learning	13
critical creative thinking mobile technology	23
key competency for creative thinking	66
learning competence mobile technologies	434
learning competency mobile technologies	316
learning to learn competence smartphones	29
mobile learning key competency	60
mobile technology key competency	86
personal key competency mobile technology	6
problem solving competence mobile technologies	38
social competence mobile technologies	220
social key competency mobile technologies	23
Key social and personal competencies mobile technology	2

2.1.2 Narrowing the initial selection to relevant studies

The initial selection was narrowed down based on an analysis of the titles and abstracts of individual papers. After a thorough analysis, 50 publications that met the criteria were included in the comparative table. These criteria include:

- The publication was published between 2010 and 2022;
- The publication addresses the relationship between mobile technologies and at least one key competency;
- The publication focuses on education at any level;
- The publication addresses education in any field;
- The publication is written in English;
- The publication contains precise procedures for the use of mobile devices;

2.1.3 Critical reading, analysis and description of relevant studies

The selected 50 publications were studied in detail. These studies were included in a comparative table in which the authors recorded the following criteria:

- title of the publication;
- Year of publication;
- Country in which the research was conducted;
- Key competencies developed;
- Target group;
- Tools or applications used;
- Role of mobile technologies, whether they had a main or supporting role;
- Keywords.

The authors then analysed the comparative table and extracted the data, which is presented in Chapter 3.

3. Results

According to the research methodology described above, the results for this paper were obtained. The results are presented in the form of a comparative table. The table contains a total of 50 records for which selected aspects are observed. The subsections below contain the results of the aspects studied.

3.1 Year of publication

The first factor that the authors looked at is the year of publication. As can be seen from the graph below, most of the publications analysed were published in 2020, 2021 and 2022. The highest number of entries that were included in the table was in the category of publications in 2021. This is 16 publications, which is almost double the number of publications in 2020. This phenomenon can be caused by several reasons. One reason may be the fact that there has been an emphasis on digital technology in education due to the pandemic situation in 2021. This situation has then been reflected in professional publications and in the issues studied. According to the annual increase in publications, it can be assumed that the number of publications will be higher at the end of 2022.

3.2 Developed key competencies

Another aspect that was investigated was the core competency, which is the focus of the analysed publication. As can be seen in the graph below, the learning competency accounted for the largest share, with 17 publications. In second place is the communicative competency, which was addressed by 14 publications. This was followed by problem solving competence, which was described in 12 publications, and the last place, with a number of 9 publications, is social and personal competency. The share of each competency may be strongly influenced by the popularity of the competencies in each country, with learning competency and communicative competency forming the basis of the education systems of most countries.

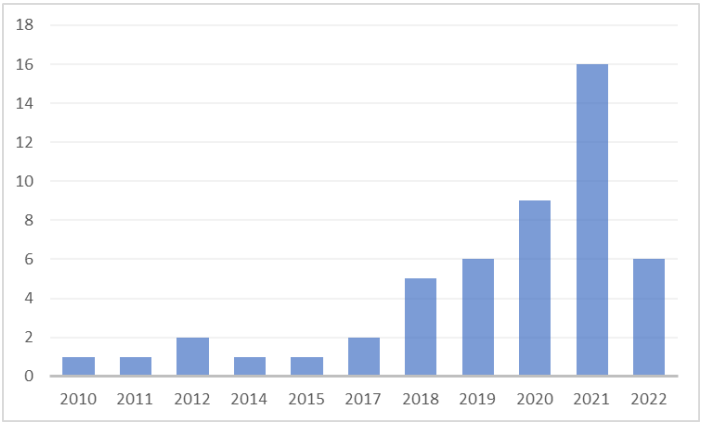

Figure 1: Number of publications found in each year

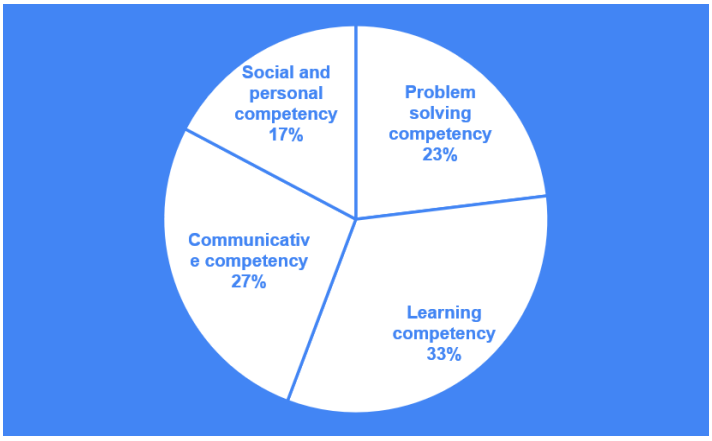

Figure 2: Proportion of key competencies in publications found

3.3 Country in which the research was carried out

The chart below lists the countries in which research was conducted in the publications analysed and, where applicable, the number of publications that covered that country. The graph shows that the highest number of publications concerned China, Spain and the USA. Taiwan was in second place, followed by Malaysia. The other countries mentioned were covered by 1 or 2 publications. As the authors are familiar with the education system in Europe, where the emphasis is mainly on the development of key competencies, they assumed that the highest proportion of publications would be within one of the European countries. It is an interesting finding that Asian countries and the USA also focus their education systems on the development of key competencies.

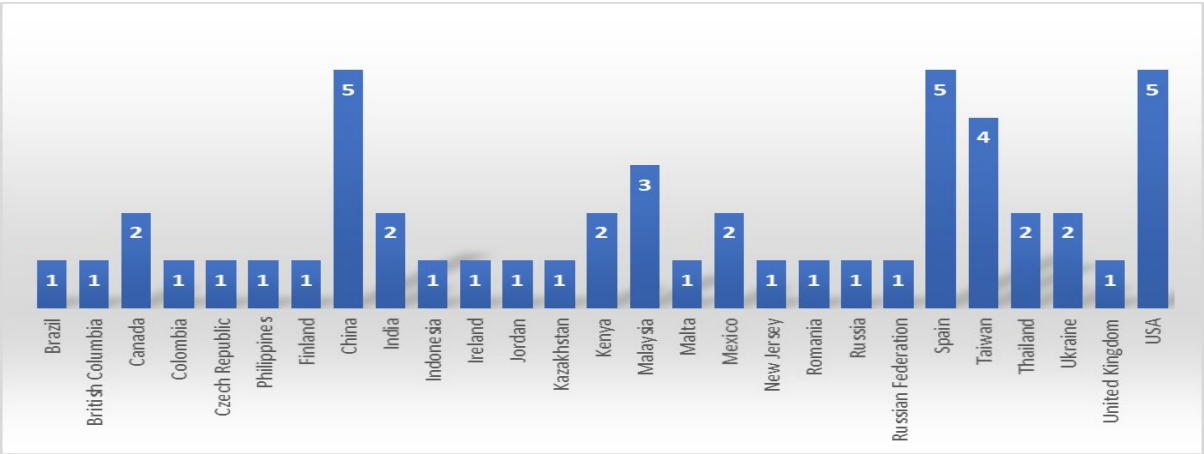

Figure 3: Overview of the countries in which the research of the analysed publications was carried out

The fourth chart (figure 4) shows the share of each competence for specific countries. More than half of the states focus on developing learning competencies, 14 states. Communicative competency comes in second place, with 9 states. An interesting indicator is that none of the publications from China focus on communicative competency and most focus on learning competency. The US has the opposite situation, with the largest number of publications addressing communicative competency and none addressing learning competency.

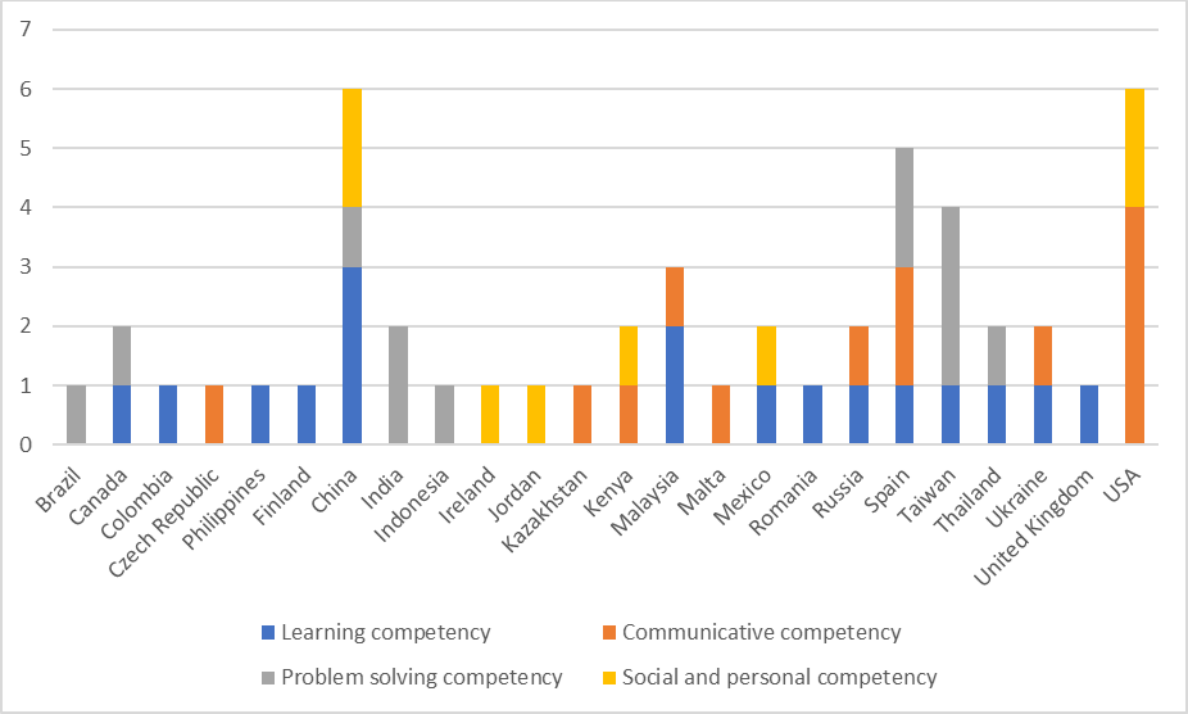

Figure 4: Share of individual competencies for specific countries

3.4 The role of mobile devices in the development of key competencies

The last aspect studied was whether mobile technology played a major role in the development of key competencies in the analysed publication or whether it was only a supporting tool. In 33 publications, mobile technologies were used as the main tool for the development of a given key competence. In 17 publications, it was only a supporting tool.

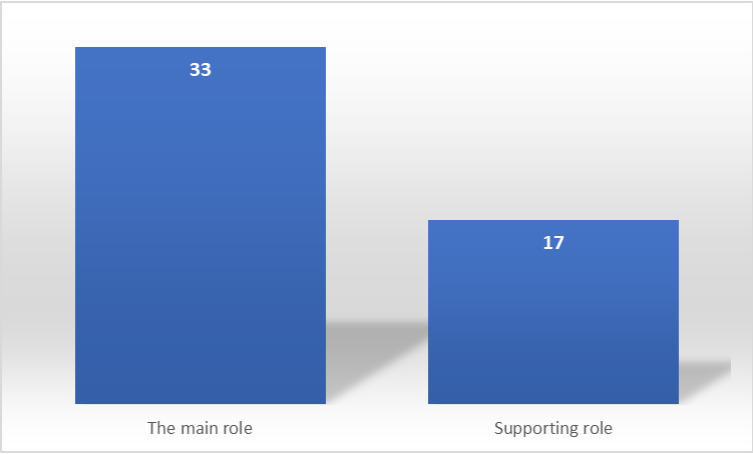

Figure 5: The role of mobile devices in the development of key competencies

4. Discussion

With the advancement of digital technologies in education, mobile technologies have gained a strong position in teaching students. For this reason, the authors focused on analyzing the relationship between mobile

technologies and key competencies in previously published research. In this paper, the authors present the investigation methodology of the conducted and the analysis of the findings.

The results show that the research problem addressed has been the focus of interest since approximately 2018, with the number of publications increasing. To date, the highest number of publications that could be found on the topic described above was published in 2021. Based on the analysis, it can be concluded that the most addressed competencies are learning competency, communicative competency and problem-solving competency, where the number of publications differs only by a maximum of five publications. As the authors mentioned above, this phenomenon may be due to the fact that these three key competencies form the basis of the educational system of many countries and are competencies that are essential in the education of an individual. Section 3.3 presents a list of the countries within which the publications analyzed were researched. China, Spain, and the United States have the highest number. Interestingly, the result is heterogeneous in terms of world continents. Despite the assumption that the highest number would be in Europe, the results show a fairly even spread also in Asia or the Americas. The last aspect analysed was whether mobile technology was the main means of developing a given key competence or whether it was only a supporting tool. The data obtained show that most publications saw mobile technology as the main tool. A variety of tools and applications were used in the studies analysed. These include educational apps, virtual and augmented reality, communication tools, social networks, applications for teaching coding, or other web-based applications.

In the context of a review study, other aspects that can be gleaned from the publications studied could also be pursued. These could be, for example, specific mobile applications and tools, the teaching methods and organisational forms used, the subject taught, etc. Another weakness of this study is the limited number of databases studied, as only the Scopus database was searched. The Web of Science, Google Scholar and other databases could also have been focused attention. Studying other databases may bring new insights into the problem and may influence the presented results. The review study is of a relatively general nature. In the context of further research it would certainly be interesting to focus attention on the individual core competencies separately. An overview study on a given key competence could look at its conception in individual countries or at specific practices in developing this competence using mobile technologies.

The development of key competencies is an important part of modern education. It is necessary to take care of the development of appropriate key competencies of pupils and students, to prepare them for their future professional life, and to make them contributing members of society. The results of this review study may form the basis for a more extensive research or further investigation. The authors plan to expand the number of articles analysed and to focus on other key competencies, such as digital competencies, work competencies, or mathematical competencies.

References

Chvál, M., and Straková, J. (2014) "Possibilities of measuring learning competencies - application of the Finnish instrument in the Czech environment", *Pedagogika*, Vol 64, No. 3, pp 307–326.

European Commission, Directorate-General for Education, Youth, Sport and Culture. (2019) “Key competencies for lifelong learning”, [online]. https://data.europa.eu/doi/10.2766/569540

Gybas, V., Kostolányová, K. and Klubal, L. (2017) “Individualization of Teaching in Special Elementary Schools with Using Mobile Touch Devices”, *2017 International Symposium on Educational Technology (ISET)*, pp 239-243.

IBM. (2022) „Mobile technology“, [online]. https://www.ibm.com/topics/mobile-technology

Klieme, E., Maag-Merki, K. and Hartig, J. (2010) “Competencies and their importance in education”, *Journal of the Czech Pedagogical Society*, Vol 20, No. 1, pp 104–119.

Mareš, J. (2013) “Review studies: their typology, function and creation”, *Journal of the Czech Pedagogical Society*, Vol 23, No. 4, pp 427-454.

Ministry of Education, Youth and Sports of the Czech Republic. (2021) “ Framework educational programme”, [online]. https://www.edu.cz/rvp-ramcove-vzdelavaci-programy/ramcovy-vzdelavacici-program-pro-zakladni-vzdelavani-rvp-zv/.

Pew Research Center. (2021) “Mobile Fact Sheet”, [online]. https://www.pewresearch.org/internet/fact-sheet/mobile/

Riadi, I., Sunardi, S. and Firdonsyah, A. (2017) “Forensic Investigation Technique on Android's Blackberry Messenger using NIST Framework”, *International Journal of Cyber-Security and Digital Forensics*, Vol 6, No. 4, pp 198-205.

Tran, D., Klubal, L. and Kostolányová, K. (2019) “Use of Selected Mobile Technologies at Lower-secondary School”, *INTED2019 Proceedings*, pp 4234-4238.

Can MOOCs Reskill and Upskill the Indian Workforce for the Industrial Revolution 4.0?

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Abstract: Industrial Revolution 4.0 is blurring the boundaries between human intellect and technology. It is characterized by technologies like Artificial Intelligence, Machine Learning, Blockchain Technology, Robotics, Internet of Things among others. The much-celebrated Industrial Revolution 4.0 will create massive job losses in developing countries including India due to the automation of jobs and processes. Thus, there is a dire need to reskill a vast majority of the workforce for the Industrial Revolution 4.0 which has already begun to be implemented due to its optimization and efficiency in resource usage. According to an estimate by OECD, the nature of 1/3rd of the jobs will transform due to technological interventions. Whereas World Economic Forum has set an ambitious target of reskilling at least 1 billion people by 2030. It believes that the world is undergoing a reskilling emergency. On the other hand, Massive Open Online Courses (MOOCs) were conceived as an online version of distance learning and are increasingly being seen as a medium for filling the skills gap. Higher Education Institutions (HEIs) are relying on the MOOCs courses along with utilizing the tools of Web 2.0 to cater to the demands of quality, affordable and accessible education to all. MOOCs also caters as a platform for the promotion of lifelong learning. COVID 19 has provided a spurt to the acceptability of MOOCs courses with most Edu Tech start-ups and MOOCs websites registering double-digit growth in the recent past. Coursera's 2020 impact report showcases that India has become the second-largest market for MOOCs with 9.84 million learners after the USA which has 14 million learners. The paper investigates the viability of the MOOCs courses in filling the skill gap as well as the reskilling of the Indian Workforce. It will also delve into whether the MOOCs courses can bridge the digital divide with the country having the world's largest unconnected population. It will critically engage with the question of whether Industrial Revolution 4.0 requires only highly specialized technology-based skills or soft skills or a combination of both for future jobs.

Keywords: Industrial Revolution 4.0, reskill, Indian workforce, MOOCs, youth

1. Introduction

MOOCs (Massive Open Online Courses) added an important and vital dimension to the Open Education movement. It seemed like a logical progression to the Open Education Resources (OERs) that served as an important database and resource tool for the academics and learners across the globe since the initial phase of computing (Liyanagunawardena, T., Adams, A. & Williams, S. 2013). The term MOOCs was coined by Stephen Downes and George Siemens in 2008 reflecting upon the idea of a 'connectivist distributed peer learning model' in education (Baturay,2014). Whereas others attribute the term of MOOCs to Dave Cormier and Bryan Alexander based on their commentary on the course run by George Siemens and Stephens Downes associated with Connectivism and Connective Knowledge (Weller, 2014). MOOCs generated an instant interest due to their potential of offering free online courses that are open to all and provide immense networking opportunities. The idea of MOOCs seemed irresistible when it appeared as the world's leading educational institutions and universities such as MIT, Stanford, Harvard began to offer such courses through various open technologies and learning management systems such as Moodle or self-created systems such as Stephen Downes' gRSShoper. The overwhelming interest of the learners and the media attention garnered by MOOCs led to the declaration of 2012 as the 'Year of the MOOCs' by New York Times (Pappano).

MOOCs have opened a myriad of opportunities for the educational institutions and even the private sector for imparting distance education and lifelong learning opportunities through the creation of digital content and communicating them through various internet-based applications, portals, and learning management systems. MOOCs are also aligned with the Sustainable Development Goals for 2030 set by the United Nations in consultation with the member states especially Goal 4 which envisages quality education as a means for upward socio-economic mobility and an almost assured chance of escaping poverty.

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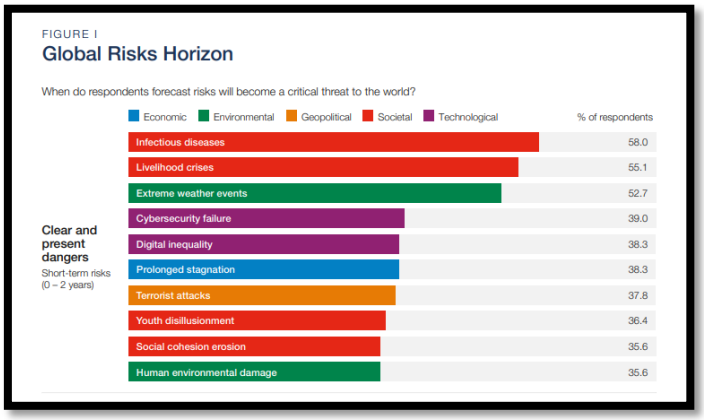
However, the low completion rates of the MOOCs courses have been considered as a major drawback, especially in a developing country. Researchers have suggested conducting comparative studies on the adoption, delivery methods, and implementation of the MOOCs courses in developed vis-à-vis developing countries (Bordoloi, Das, and Das, 2020).

Industrial Revolution 4.0 has been characterized by an overwhelming overlap between human intelligence and technology and in some cases, it even far exceeds human intelligence. It is characterized by a significant transition from the electronic-based industries to the fusion of new and emerging technologies like Artificial Intelligence, Robotics, Nanotechnology, Internet of Things in each aspect of the smart factories. The rapid change would be ushered by the interconnectivity between devices and automation leading to newer and higher levels of efficiency, better decision making, and enhanced level of responsiveness to the customers. Smart Factories would be embedded with advanced sensors, software, and robotics to facilitate machine-to-machine communication and the Internet of Things. It has been viewed as a paradigm shift in industrial capitalism which would be epitomized by the increased automation, predictive maintenance, and self-optimization of the processes.

According to the World Economic Forum's Global Risks Report, 2021 over 85 million jobs will get automated in the coming five years thus, seeking an urgent need for the re-skilling of the youth and preparing them for the changing nature of work. Global Risks Report 2021 also mentions that 'livelihood crises' have been ranked as the second topmost short-term risk to the world as 'infectious diseases' as per the Global Risks Perception Survey.



Source: World Economic Forum's Global Risks Report 2021

Figure 1: Global Risks Horizon

Whereas a report by McKinsey Global titled 'The Future of Work after COVID 19' estimates that 100 million people will have to find a new job by 2030 across the top eight economies of the world (China, France, Germany, India, Japan, Spain, the United Kingdom, and the United States) that account for around 62 % of the GDP of the world. The solution to the massive problem lies in the reskilling and upskilling for the current workforce and newer individuals joining the workforce. While World Economic Forum's Future of Work Report 2020 shows that employers have braced themselves for the challenge and in the second quarter of 2020 at least 1/5th of the employers have begun to provide opportunities to their employees for online learning and up gradation to meet the challenges of future ushered due to the digital leap. (Monaghesh and Hajizadeh. 2020). Whereas a survey conducted by Udemy for the Indian Workforce showcases that at least 92% of the employees themselves feel that there is a skill gap and they need to update their skills to remain relevant to the job market and competition.

2. Objectives of the paper

From the aforementioned deliberations, it may be assumed that there is a dire need for the reskill and upskill of the workforce in general across the globe along with the Indian Workforce which is facing a crisis due to the skills gap and may face livelihood crises in the near future due to the paradigm shift in the production of goods and services facilitates by the technologies that form the foundation of Industrial Revolution 4.0. Massive Open Online Course is an important digital tool that has been utilized by various government and non-government platforms for imparting new knowledge, skills, and full-time distance education. Thus, the paper aims to understand:

- 1. Viability of the MOOCs courses in filling the skill gap or upskill the Indian Workforce to meet the challenges of the future with the emergence of Industrial Revolution 4.0.
- 2. Can MOOCs play a vital role in imparting both vocational/technical skills and soft skills for future job requirements.

3. Review of literature

MOOCs are essentially free online courses that are open to all interested participants where educators use various technological tools to provide knowledge and content to those enrolled in the programmes.

3.1 Characteristics of MOOCs

According to Baturay (2014), the key features of a MOOC's course are Open, Participatory, and Distributed. Here, Open refers to the ability of any interested individual with internet access to join a course without any difficulty gaining access to course and content shared publicly and even join discussions related to the course. Whereas Participatory refers to the active engagement of the learners with others including instructors, however, such participation remains voluntary. The third aspect is 'Distributed' has its roots in the connectivist approach where the course materials are circulated over a network and such materials act as an initial simulation for discussions, analysis, and further thinking facilitated by technology. Various MOOCs models have also been developed since their inception such as cMOOCs, XMOOCs, LOOCs, SMOCs.

According to Rohs and Ganz (2015), massive open online courses (MOOCs) hold great promise for lowering barriers to higher education because they charge low or no fees, can accommodate an endless number of students, and even circumvent the restrictions of space and time. Whereas World Bank (2012) said that such courses can serve as viable alternatives to formal educational systems, particularly in developing nations where access to higher education is constrained by a variety of restrictions and barriers. Though empirical evidence indicates that MOOCs and social mobility have yielded mixed results, with some studies indicating a higher career growth trajectory for individuals from disadvantaged backgrounds in relation to lower financial investments (Zhenghao, Alcorn, Christensen, Erikson, Koller, and Emanuel), and others indicating greater enrollment barriers for students from such backgrounds (Yanez, Nigmonova, & Panichpathom, 2014).

3.2 Limitations of MOOCs courses

Several empirical investigations (Liyanagunawardena, Adams, and Williams (2013) and the University of Pennsylvania in England) have demonstrated that the completion rates of MOOC courses are abysmally low, i.e., less than 10 percent. Numerous academics attribute significant dropout rates to the enormous number of "leisure learners" enrolling in these open and free courses. They believe that the goal of these students is never to complete a course or receive recognition, but rather to acquire the necessary skills and knowledge and then quit the course. As a remedy, several academics propose that the actual number of students enrolled in a course should be determined one week after the course's start date. Those learners who are active after the first week of the course should be considered "real learners" Some researchers have posited that insufficient supervision and a lack of importance placed on students' participation have contributed to the learners' disengagement (Vardi, 2012 Zapata-Ros,2013).

Furthermore, the lack of presence of a teacher/professor and the personal touch of the instructors also leads to disinterest in the course among learners (Kang & Im, 2013). Similarly, MOOCs courses limit the possibilities of doubt resolution in the virtual environment unlike in the classroom teaching where the doubts could be discussed, clarified, or resolved on the spot on a real-time basis (Atiaja, Guerrero, 2013).

Some of the important barriers identified by King, Pegrum, and Forsey (2018) to MOOCs and OERs in the Global South are:

- **Access to Internet**: They asserted that there are huge gaps in the rural area participation in the overall MOOCs participation from Global South due to Access to the Internet and other infrastructure barriers such as power supply, availability of computers among others. They showed a positive correlation between the regional enrolment into MOOCs courses and the strength of broadband bandwidth. There was a clear gender divide in Access to internet facilities.

- **Language Proficiency and Digital Literacy Skills**: Researchers have identified that around 75% of the MOOCs courses are in the English Language which marginalizes the native language speakers in Global South. Language Proficiency acts as a huge barrier to understanding the content and context of the course being taught. Digital Literacy Skills i.e., using keyboards, mouse, desktop computers limit the access to MOOCs courses however, it has been identified that Mobile Phones with simpler functionalities can bridge the barrier to a certain extent.
- **'Foreign' Nature of the Content**: Most MOOCs courses flow from North American or European Universities having limited relevance to the students of the Global South. The theories and examples of the MOOCs courses are not well adapted to the realities of the Global South.

3.3 MOOCs in India

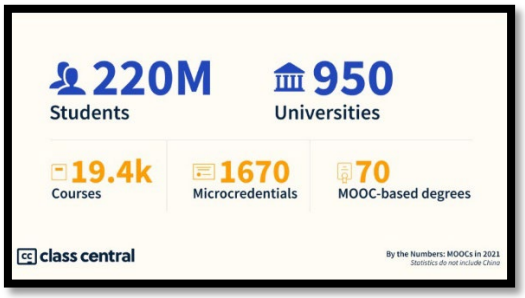
Recognizing the relevance of the MOOCs in the Open Education Movement, the Government of India launched its own MOOCs platform SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) Platform in 2016 under the purview of the Ministry of Human Resource Development (now Ministry of Education) (now Ministry of Education). The government selected nine national coordinator institutions to design, create, and deliver Massive Open Online Courses (MOOCs) courses to learners across India in a variety of fields, including multidisciplinary courses, beginning with the ninth grade.

A study conducted by Singh and Chauhan (2017) related to the application of MOOCs for the pre-service and in-service teacher for professional development showed that awareness amongst the teachers regarding the SWAYAM courses is low.

The Indian government has introduced the National Education Policy, 2020, which makes particular provisions for the incorporation of technology in higher education institutions (HEIs) in India and even promotes the concept of online learning via platforms such as SWAYAM. It seeks to create digital content, a digital repository, virtual labs, and an academic credit bank in order to promote digital education in India. Academic Credit Bank will facilitate the transfer of credits from MOOC courses to university students who are already enrolled. The University Grants Commission has increased the academic credit ceiling for online courses from 20 percent to 40 percent. According to the new government regulation, enrollment and participation in a MOOC course would be regarded equivalent to attending physical lectures in a classroom.

3.4 MOOCs in COVID 19 Pandemic

In an article titled 'Remember the MOOCs? After Near-Death, They're Booming' published in New York Times in May 2020, a 'renaissance' for the MOOCs courses was predicted – nearly a decade after its launch. The article makes an important observation that MOOCs courses have grappled with low completion rates with a 10% or lower rates whereas paid courses or those associated with earning credentials had around 40%-90% completion rates. Other strategies that were adopted by the various MOOCs platforms included having collaborations with the corporates and a visible tilt towards focussing on the development of skills especially those dubbed as future skills such as Data Science, Artificial Science, programming. One such platform is Udacity which made collaborations with brands like Google, Mercedes, Amazon to create courses apart from their courses.



Source: Class Central: A Decade of MOOCs: A Review of MOOC Stats and Trends in 2021

Figure 2: Class Central: A decade of MOOCs

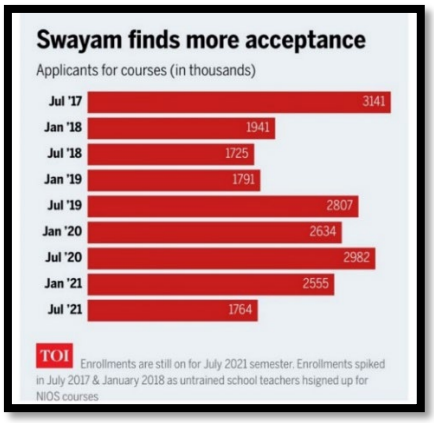
According to A Review of MOOCs Stats and Trends in 2021 given by Class Central, there has been a massive growth of MOOCs enrolments over the decade. As per the review, the MOOCs movement began with the three

courses offered by Stanford University in 2012 with only 300K learners which have increased to 220K in 2022. In 2021, 3100 MOOCs courses were launched along with 500 Micro-credentials. Whereas the A Review of MOOCs Stats and Trends in 2020 by Class Central dubbed 2020 as the 'Year of MOOCs'. COVID 19 Pandemic gave an impetus to the MOOCs enrolments as learners across the globe both university students and professionals got more time in their hands due to remote work conditions and shutting down of the universities across the globe. Such conditions were necessitated due to the government-imposed lockdowns and work from home advisories in various countries. According to the 2020 Review, the three MOOCs platform Coursera, edX and FutureLearn combined attracted more users in April 2020 than all the users garnered by them in entire 2019. There was also a significant shift in the subjects opted by learners in pre-pandemic and post-pandemic situations. Technology-related subjects dominated the enrolments in the pre-pandemic situation whereas the post-pandemic situation oversaw a significant rise in soft skills and general topics-related courses. Though, 1/5th of the courses was related to COVID 19 pandemic with John Hopkin's Course on COVID 19 Tracing leading the list. On the other hand, Yale University's Science of Well Being saw 2.5 million enrolments in 2020 which were highest across all courses and categories of MOOCs courses.

Source: Class Central: The Second Year of The MOOC: A Review of MOOC Stats and Trends in 2020

Figure 3: Class Central: The second year of the MOOCs

Another important aspect highlighted by the Report of 2021 was the rise of non-university courses on the various MOOCs portal. The most renowned technology brands such as Amazon, Google, Microsoft, Facebook are creating MOOCs courses. Coursera had 31% non-university-created courses in 2020 which rose to 39% in 2021. edX saw a rise of 10% in such courses as it had 16% such courses in 2020 which rose to 26%. FutureLearn had 38% such courses in 2020 whereas in 2021 it had 51% courses from various companies. In the Indian context, there has been a rise in the acceptance of MOOCs courses, especially from the SWAYAM Portal as reported by Times of India in an article titled 'What makes Swayam attract IITs, IIMs, and crores of students? in August 2021. The news article reported that the platform oversaw 1.1 crore enrolments between July 2019 to January 2021. Thus, it attracted almost 27.44 lakhs learners every semester from 2019.



Source: Times of India -What makes Swayam attract IITs, IIMs, and crores of students? published

Figure 4: Times of India

According to the report, some of the popular courses on the platform are Python for Data Science, Machine Learning, Data Structures, and Algorithms using python and programming. Until 2021, at least 149 universities accepted the credit transfer from SWAYAM MOOCs courses earned by the learners. The learners completing the course and taking the end-term proctored examination on SWAYAM Platform have also risen with around 70,000 learners attempting the examination in 2018 to nearly 2 lakh learners taking the examination in 2019 and 2020.

4. Data collection

A descriptive and exploratory research methodology has been utilized for the study. The sources for the descriptive research were derived from an extensive search of two online databases Google Scholar and JStor for the particular study based on their relevance to the research objectives. The search words were MOOCs+India, MOOCs+Upskill, MOOCs+Reskill, MOOCs+Technical Skills, MOOCs+Vocational Skills, MOOCs+Soft Skills, and MOOCs+Higher Education. However, enough data sets were not available for meta-data analysis.

5. Results

According to a study titled Lifelong Learning opportunities through MOOCs in India (2020), the most prominent issue with the government-sponsored MOOCs offered was the high dropout rate with almost more than 97% cumulatively. The study analyzed the data from the three National MOOCs coordinators namely Consortium of Educational Communication (CEC), University Grants Commission (UGC), and Indira Gandhi National Open University (IGNOU) that offers courses through the SWAYAM platform. The learners who had finished the course and applied for the final examination were less than 3% for UGC, under 2% for CEC, and less than 1.01% for IGNOU. The other barriers and challenges that they identified regarding the Indian MOOCs courses were lack of a common framework and ecosystem for MOOCs throughout the country, lack of teacher's acquaintance with the ICT technologies for educational purposes, unavailability of proper infrastructure to offer technology-based learning for the learners and digital divide. The hassle borne by the learners was credit transfer through MOOCs courses also becomes a barrier for the students whereas in some cases, universities do not offer such options for credit transfer.

Another study titled 'Bridging Students' Soft Skills Gaps with MOOCs' about eLene4Work Project under Erasmus+ Programme was carried out in 9 European Countries between 2014-2017. The study was aimed to gauge the viability of MOOCs courses in imparting soft skills including digital soft skills. Imparting soft skills has an inherent challenge of bringing behavior change component. The researchers were trying to understand the feasibility of MOOCs courses for soft skills for the vacancies in labour market. The countries included in the study were Belgium, France, Germany, Greece, Finland, Italy, Poland, Spain, and United Kingdom. The study revealed that it was difficult to accommodate the learners with no knowledge in the subject with the students with a Ph.D. in the subject in a single course. It also identified that rich sources have to be developed to bring diversity which aids the learning and understanding of the participants. It recognized that engagement with the learners regarding their understanding and class materials is essential. It also emphasized the discussions taking place in participant-created digital spaces and vouched for creating social media groups to continue the discourse beyond the course as well. It identified tools and project-based MOOCs as more viable for imparting soft skills than traditional MOOCs with recorded lectures and assignments. It recognized the language as a barrier to the participants and success of the MOOCs courses.

'Paving the Way for the Future of Work' – a Canadian study recommended the alterations in the public policy to meet the demands of the future of work especially in the gig economy conditions where skills become redundant with the emergence of newer technologies every few years. It emphasized that academic institutions should prepare themselves for the on-demand upskilling courses as many sectors across the economy need a workforce equipped with newer technologies such as IoT, Augmented Reality, Machine Learning, 3D Printing. It recommended MOOCs and Boot Camps for courses like Coding for the regular updating of skills in the gig economy. It also gave the solution that tuition fees for such courses may be viewed by learners as part of the future salaries.

Another study titled 'MOOCs and Upskilling in Australia: A Qualitative Study' showcased that MOOCs offered great flexibility to those employed in the various industries. The flexibility and the low cost of the courses were an advantage for the employed learners as they could manage their family and job commitments along with the acquisition of new and updated skills. The study pointed out that even professional associations recognized the contribution of MOOCs courses for gaining new credentials for the working professionals. It asserted that

MOOCs courses are ideal for the 21st-century work place which needs rapid technological adaptations. It believes that MOOCs offer an opportunity to the professionals to upskill themselves beyond the traditional university set up and diversify their portfolio through earning credentials. The study also recognized the need for more research in terms of the 'quality' of MOOCs courses as well as their 'success' rates in Australia. It also pointed out the low support from the employers for undertaking such courses as well as the lack of accreditation from the educational councils in the country.

6. Conclusion

MOOCs offer great potential for upskill and reskill the Indian Workforce especially with regards to the skills required for coping with Industrial Revolution 4.0. However, Upskilling and Reskilling remain a 'bottoms up' movement with learners being more pro-active in the voluntary updation of the skills. MOOCs should be considered as a viable open for reskilling and upskilling by both the government institutions and companies. However, there is an increased need for more research on the design, development, and delivery of the MOOCs courses for developing 21st-century skills in the learners considering the high attrition rates of the courses.

References

Atiaja, L. and Guerrero, R. (2016) "MOOCs: Origin, characterization, principal problems and challenges in Higher Education," *Journal of e-Learning and Knowledge Society*, 12(1), pp. 65–76

Anani, N. (2018) "Paving the way for the future of work," *Canadian public policy. Analyse de politiques*, pp. 1–10. doi: 10.3138/cpp.2018-012.

Bordoloi, R., Das, P. and Das, K. (2020) "Lifelong learning opportunities through MOOCs in India," *Asian Association of Open Universities Journal*, 15(1), pp. 83–95. doi: 10.1108/aaouj-09-2019-0042.

Baturay, M. H. (2015) "An overview of the world of MOOCs," *Procedia, social and behavioral sciences*, 174, pp. 427–433. doi: 10.1016/j.sbspro.2015.01.685.

Bandalaria, M. D. P. (2018) "Open and distance eLearning in Asia: country initiatives and institutional cooperation for the transformation of higher education in the region," *Journal of Learning for Development*, 5(2).

Corti, P. *et al.* (2014) "Bridging S tudents ' Soft Skills Gaps with MOOCs," *International Journal for e-Learning Security*, 4(2), pp. 382–384.

ETHRWorld (2022) *How the pandemic has created a fresh challenge for upskilling the workforce*, *ETHRWorld Contributor*. Available at: https://hr.economictimes.indiatimes.com/news/workplace-4-0/learning-and-development/how-the-pandemic-has-created-a-fresh-challenge-for-upskilling-the-workforce/88629129 (Accessed: January 1, 2022).

Education Desk (2020) "UGC doubles credits allotted to MOOCs, asks colleges to develop online courses," *The Indian Express*, 3 August. Available at: https://indianexpress.com/article/education/ugc-doubles-credits-allotted-to-moocs-asks-colleges-to-develop-online-courses-6537513 (Accessed: June 16, 2022).

Eugenia, C. *et al.* (no date) *DeMOOCratization of Education?: Massive Open Online Courses (MOOCs) and the opportunities and challenges for developing countries*, *Graduateinstitute.ch*. Available at: https://repository.graduateinstitute.ch/record/286962/files/MOOCs_Full_Final.pdf (Accessed: June 16, 2022).

Hew, K. F. and Cheung, W. S. (2014) "Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges," *Educational research review*, 12, pp. 45–58. doi: 10.1016/j.edurev.2014.05.001.

Kang, M. and Im, T. (2013) "Facors of learner-instructor interaction perceived learning outcomes in Online learning environment," *Journal of Computer Assisted Learning*, 29(3), pp. 292–301.

King, M., Pegrum, M. and Forsey, M. (2018) "MOOCs and OER in the global South: Problems and potential," *The International Review of Research in Open and Distributed Learning*, 19(5). doi: 10.19173/irrodl.v19i5.3742.

Liyanagunawardena, T. R., Adams, A. A. and Williams, S. A. (2013) "MOOCs: A systematic study of the published literature 2008-2012," *The International Review of Research in Open and Distributed Learning*, 14(3), p. 202. doi: 10.19173/irrodl.v14i3.1455.

Littlejohn, A. (2013) *Understanding Massive Open Online Courses, CEMCA*. New Delhi.

Lund, S. *et al.* (2021) *The future of work after COVID-19*, *Mckinsey.com*. McKinsey & Company. Available at: https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-after-covid-19 (Accessed: June 16, 2022).

HR News (2021) *ETHRWorld.com*. Available at: https://hr.economictimes.indiatimes.com/news/workplace-4-0/learning-and-development/21st-century-needs-india-to-upskill/8265644436 (Accessed: January 2, 2022).

Nisha, F. and Senthil, V. (2015) "MOOCs: Changing trend towards open distance learning with special reference to India," *DESIDOC journal of library and information technology*, 35(2), pp. 82–89. doi: 10.14429/djlit.35.2.8191.

Pappano, L. (2012) "The year of the MOOC," *The New York times*, 2 November. Available at: https://www.nytimes.com/2012/11/04/education/edlife/massive-open-online-courses-are-multiplying-at-a-rapid-pace.html (Accessed: January 3, 2022).

Rohs, M. and Ganz, M. (2015) *MOOCs and the claim of education for all: A disillusion by empirical data. The International Review of Research in Open and Distributed Learning*.

Swayam central (no date) *Gov.in*. Available at: http://www.swayam.gov.in (Accessed: June 16, 2022).

Santandreu Calonge, D. *et al.* (2019) "MOOCs and upskilling in Australia: A qualitative literature study," *Cogent education*, 6(1), p. 1687392. doi: 10.1080/2331186x.2019.1687392.

Singh, G. and Chauhan, R. (2017) "Awareness towards massive open online courses (MOOCs) and their usage for teacher education in India," *Asian Journal of Distance Education*, 12(2), pp. 81–88.

Shah, D. (2021) *A decade of MOOCs: A review of MOOC stats and trends in 2021 — class central*, *The Report by Class Central*. Available at: https://www.classcentral.com/report/moocs-stats-and-trends-2021/ (Accessed: January 7, 2022).

Shah, D. (2020) *The second year of the MOOC: A review of MOOC stats and trends in 2020 — class central*, *The Report by Class Central*. Available at: https://www.classcentral.com/report/the-second-year-of-the-mooc/ (Accessed: January 9, 2022).

Unstats.un.org. (No date b) Available at: https://unstats.un.org/sdgs/report/2016/the%20sustainable%20development%20goals%20report%202016.pdf (Accessed: June 16, 2022).

Vardi, M. Y. (2012) "Will MOOCs destroy academia?," *Communications of the ACM*, 55(11), pp. 5–5. doi: 10.1145/2366316.2366317.

Weforum.org. (No date) Available at: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf (Accessed: January 10, 2022).

Weller, M. (2014) *The Battle For Open How openness won and why it doesn't feel like victory*. Ubiquity Press.

World Bank (2014) *World development indicators 2012*. Washington, D.C., DC: World Bank Publications. doi: 10.1596/978-0-8213-8985-0.

Zapata-Ros, M. (2013) *MOOCs, a critical view and a complimentary alternative: The individualization of learning and pedagogical help*.

Zhenghao, C. *et al.* (2015) *Who's benefiting from MOOCs, and why. Harvard Business Review Who's Benefiting from MOOCs, and Why (hbr.org)*.

Zapta-Ros, M. (2013) *Assessment in the New Paradigm of Education in Post-industrial Knowledge Society.e-prints in library and information science*.

inDICEs: A MOOC on Developing Digital Transition Strategies for Cultural Heritage Institutions

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Abstract. In the Horizon 2020 project inDICEs, a consortium of 14 interdisciplinary partners from research and industry set out to develop an approach on how to understand and measure the impact of digital cultural heritage. Synthesising the results of three years of research, the consortium produced a MOOC on the KULeuvenX edX platform, focused on the development of digital transition strategies for both non-profit business models in heritage institutions as well as broader cultural and creative industries. Built on KU Leuven's experience in developing MOOCs derived from Horizon research, this particular online course is part of a specific segment of the university's MOOC offerings targeting primarily a professional audience. It is the third MOOC in a series intended for current and future professionals in the GLAM sector. In this paper, we discuss the choices behind the development of such a MOOC, and the strategic role such MOOCs play in the business model of the university, particularly with regards to micro-credentials. It also highlights the opportunities that networking with industry stakeholders opens for higher education and research organisations, as a not-for-profit valorisation effort. The MOOC brings insights on data monitoring and trend watching, copyright and digital asset management and development of digital strategies. Most importantly, it positions these topics within the context of new digital value chains for heritage institutions fostered by open access and participatory engagement models. As such, this paper will be of interest both to communities of MOOC developers - to understand how stakeholder communities and professional networks can steer choices, formats and approaches - as well as university MOOC business plan developers. Furthermore, as this MOOC embodies the growing interest of teachers and scholars in digital collections, it will also provide insights into opportunities such formats provided to the education and research sectors. Finally, it will speak to anyone working on MOOCs on the topic of cultural production and heritage.

Keywords: MOOC, digital transformation, digital strategy, galleries libraries archives museums (GLAM)

1. The need for digital transition strategies in GLAM

Previous research done in the context of Europeana[1], the European portal for Cultural Heritage, and NEMO[2], the organisation of European museums, shows that many smaller to mid-size GLAM (Galleries, Libraries, Archives and Museums) institutions struggle to develop a coherent, encompassing digital strategy, to integrate digital collections in their general workflow.[3] This became very apparent during the COVID-19 epidemic, but reflects a more endemic, structural issue. The need to replace on-site visits with online interactions forced many institutions to scramble for visibility on the web - testimony to this is the appearance of new roles such as a social media manager - and producing one-off 3D showcases. However, in many cases there were insufficient resources available and not enough planning time to structurally embed this in a new way of working and real digital agency (Truyen & Bočytė, 2021).

This becomes most apparent in the possibilities that social media offer and how they relate to the digitised collections and GLAM operations. It is about the social in social media. Although there are quite some studies discussing the value of digital communications for museum marketing (Amalia & Hanika, 2021), one should also take into account possible harmful effects of underlying algorithms (Petrescu & Krishen, 2020), e.g. in reinforcing gender bias (Schroeder 2021). Moreover, these platforms do not necessarily improve social well-being (Ryan et al, 2017) - while there is evidence that actual onsite heritage visits do (Sofaer et al, 2021). However, in particular for GLAM institutions, the combination of web presence, apps and social media activity provides an ideal opportunity to develop participatory practices that help to reconnect heritage collections to

[1] http://www.europeana.eu
[2] https://www.ne-mo.org/
[3] See https://pro.europeana.eu/project/europeana-common-culture, in particular the report "MS3 Landscape of national aggregation" and https://www.ne-mo.org/advocacy/our-advocacy-work/museums-during-covid-19.html

stakeholder communities and audiences (Fernandez-Lores et al, 2021). In fact, many institutions already tap into the power of crowdsourcing, often to help in identification of heritage objects and the enrichment of metadata (Davies, 2020). But it could go much further than that: communities might want to and should have opportunities to contribute earlier in the internal decision processes of the heritage institutions, e.g. by co-deciding on digitisation priorities, content selection and even curation. Where digitisation and the publication of digital collections can be considered an inside-out process, relying mostly on the knowledge and capacities of the institution, participatory and co-creative platforms can implement a more outside-in approach, bringing the communities who define objects as being heritage back into the process. This is an important paradigm shift that acknowledges and positions communities as knowledge experts (a role previously reserved for heritage professionals) and heritage organisations as facilitators enabling those communities to bring their expertise and continuously reinterpret and bring new meanings to heritage collections.

2. The inDICEs research

The Horizon 2020 project inDICEs tries to develop a new way to measure the impact of digital culture, focusing on the role of cultural heritage institutions. Our historical heritage can be considered as a key enabler of the advancement of the Cultural and Creative Industries in Europe, when these heritage contents are opened up for rediscovery and reuse. In this sense, CH institutions can be seen as R&D labs of the cultural and creative ecosystem. However, researchers and policy-makers are struggling to fully understand the crucial role that the Cultural Heritage Sector can play in the digitisation process of the cultural and creative ecosystem in Europe.

inDICEs aims to inform policy-makers and empower decision-makers in the Cultural and Creative Industries so that they realise the social and economic impact of digitisation in the sector and create the necessary environment to stimulate innovative (re)use of cultural assets. Based on influential research on modes of cultural production (Sacco et al, 2018) as well as research on impact models (Tanner, 2020) and creative value chains (Devoldere et al, 2017) , further in-depth research has been done to consolidate data gathering, enable monitoring and perform analytics to formulate policy recommendations (Sacco et al, 2021).

In its Open Observatory[4], inDICEs aims to track policies and provides tools to discuss, measure and advance the impact of cultural heritage in Europe. This can help the development of policy priorities for digital transformation in the sector. The inDICEs consortium brings together internationally renowned research groups in the domains of Cultural Economics, IP Law and Digital Humanities, representatives from CCI networks and institutions with deep outreach capacity, social innovators and platform developers. The research is data driven: data are gathered from both existing repositories and archives and from specific data collection activities carried out on digital platforms and social media, and analytics is applied to detect and showcase important trends in cultural production and reuse. Another important part of the research, reflected in the MOOC, is an analysis of the legal copyright framework in Europe and how it is conducive or not for creative reuse of cultural content (Janssens et al. 2021).

To sum up, with its impact methodology, the project develops models to measure the socioeconomic impact of access to cultural goods and new modes of content production enabled by digital cultural heritage and at the same time we map Intellectual Property frameworks on European and national levels to understand how they could enhance the competitiveness of the cultural heritage sector. This allows us to develop new business models, best practices and tools to implement creative value chains that help individual organisations overcome bottlenecks in creative reuse and consumption of digital heritage. All this is embedded in a participatory approach to engage stakeholders in collaborative co-creation and introduce a model for community participation built around ethical principles. Finally inDICEs made a study of existing self-assessment tools for digital strategy in the GLAM sector, and developed - on the basis of the widely used ENUMERATE surveys - an interactive Self-Assessment tool for heritage institutions. In this context, the development of a MOOC aimed at summarising the most interesting results of the inDICEs project while simultaneously giving cultural institutions direction on how to confidently navigate the digital realm, represented a natural evolution of the project. Since the beginning of its development, the MOOC was designed based on a set of recommendations addressed to CHIs (Bočytė & Truyen 2021; Janus et al. 2021), which contained the major results of the main inDICEs research areas: digital transformation and self-assessment, digital trends, IPR, capacity building and value chains, impact assessment, and technological innovation. This research areas represented not only the different Work Packages of the project, but also reflected the table of content of the MOOC, as highlighted in the table below.

[4] https://participate.indices-culture.eu/

Table 1: Table of content of the MOOC

Module 1	Digital transformation & self-assessment
Module 2	Digital trends and culture 3.0
Module 3	Empowering IPR for the commons
Module 4	Strategic skills, collaborations & organisation growth
Module 5	Impact assessment
Module 6	Approaching technological innovation

This went hand in hand with thorough collaboration between experts coming from the research sectors explored in the project and the KU Leuven digital education team, which transformed and adapted the experts' ideas and the project's results to fit within a MOOC learning environment.

3. Why a MOOC?

Contrary to the original concept of MOOCs, which were meant as open online versions of university courses, and sometimes literally recordings of such classes, this MOOC fits in a series stemming directly from international research projects. Instead of delivering established academic knowledge to a wider audience, this MOOC is an example of an effort to shortcut the time of delivery of new knowledge to a professional audience. Besides the typical postgraduate students found in MOOCs, it is supposed to attract professionals and aspiring professionals, to make sure new insights reach the work floor.

A second aspect that sets this MOOC apart is the fact that the research does not only come from academic institutions but emerges from a collaboration between university research departments and GLAM organisations. Both parties have good reasons to engage in these efforts. For the universities involved, research in collaboration with the professional field offers an important reality test and validation exercise for new ideas. It gives access to hitherto inaccessible resources, which are held, in our case, in heritage institutions. More importantly, it gives access to the audiences and stakeholders of these institutions. This facilitates new ventures such as e.g. Citizen Science projects.

Because of these elements, this MOOC does not entirely insert itself within the type of educational approach generally conceived by edX, which usually orients its courses towards a textbook-structure model (also recognized as xMOOC), which favours independent learning over interaction (Waller et al, 2019). Instead, it can be recognized as a dynamic learning environment which shares elements both with the xMOOC approach and the collaborative MOOC model (cMOOC) (Mary Queen & Vel Murugan, 2020). The integration of aspects belonging to both models aimed at creating an environment that could enhance knowledge acquisition through collaboration and connection among participants and not uniquely through passive learning (Wang et al. 2017, Siemens 2005). There are also more practical reasons universities want to connect their study programmes to the labour environment, such as, for example, facilitating job uptake not only for graduates but also for postdoctoral researchers, as there are many more PhD researchers than academic vacancies.

But how does a MOOC fit in all of this? A recent development in the business model of many universities, and in particular in Europe, is the elaboration of a micro-credential system[5]. Currently, due to advanced digital platforms and tools offered by online learning solutions, there is a myriad of informal learning going on, which has difficulties connecting to formal learning. On the one hand, there is a need for a wide variety of very specific, job-oriented learning modules, on the other, there is a need for certification of knowledge and skills acquired in such way. For universities, there is a clear motive to facilitate the transition from partial, specific learning components to degree learning. Micro-credentials are meant to play an important role in facilitating this[6]. And, as it happens, a very flexible way to organise micro-credentials is to offer MOOCs.

[5] See https://education.ec.europa.eu/education-levels/higher-education/micro-credentials
[6] See e.g. https://mce.eadtu.eu/ and for an attempt at definition https://www.voced.edu.au/content/ngv:91634

It needs to be acknowledged that similar criticisms are being forwarded towards micro-credentials as were advanced against MOOCs during their introduction and hype in the period 2008-2012 (Daniel 2012; Boullier 2012; Holton 2012), such as that it doesn't solve structural problems in formal education (Boud & Jorre 2021), that it has too much of a focus on employability than on Bildung (Wheelahan & Moodie 2021), that its impact on the Higher Education business model is limited (McGreal & Olcott 2022). However, in this case registered university students are also invited to join the MOOC as part of their formal classes, to attract better dialogue between students, aspiring professionals and professionals. Of course, part of the aim is improving employability, but it also encourages students to critically assess current labour organisation in GLAM starting on a reflection of its declared core mission, which is part of the MOOC activity. It is a much more cyclic, integrative, two-way learning and teaching approach than the linear supply chain model which is presupposed by many critics. It actually brings institutional and expert knowledge into the academic program.

For the professional organisations, in our case from the heritage sector, contributing to the development of a MOOC and sharing their expertise would be beneficial in the academia at an educational level. As participating in the MOOC is free, it is also a way to support in-house capacity building. This is the main reason why important GLAM network organisations were part of the innovation project behind the MOOC.

4. Previous MOOC experience

There are important differences between MOOC content and academic course content. One aspect is the difference in implicit context: while an academic course is embedded in a larger education program, and often builds further on previously taken courses, a MOOC is a stand-alone course. This also means that a lot of process information, which is normally given by the educational institution or the professor, needs to be made explicit in the MOOC.

There is also a difference in duration, as it does not really make sense to have one hour recordings for the MOOC, as online consumption habits are quite different and oriented to shorter content digestion. This meant that for the development of this MOOC it was needed to rely on in-house expertise at the university to develop the content as well as the learning activities in the MOOC. The support team at KU Leuven uses an ABC design model[7] for this which allowed the design of a well-structured development environment. Fortunately, for the current MOOC the academic team also had previous experience with developing MOOCs for the humanities, such as "Europeana Space: Creative with Digital Heritage", "Creating a Cultural Heritage Community" and Euro-noir: Cultural Identity in European Popular Crime Narratives.[8] This helped us to understand the mechanics of developing a coherent MOOC with the collaboration of distant, independent, multi-disciplinary research teams. Creating such a MOOC with a large number of contributing partners - in these cases including university research groups from engineering and a diversity of humanities disciplines, SME's, large professional networks and non-profit/not-for-profit organisations, requires a rigorous development and implementation planning. It also requires a lot of fine tuning and the setup of a joint quality control and content "normalisation" procedures. For the MOOC student, the wording, style, formatting and presentation of the different content modules must be sufficiently aligned and of comparable accessibility level. This was a major undertaking requiring a quite elaborate editorial and reviewing protocol.

In the area of transformation and management in the cultural heritage sector, it is possible to find interesting examples of MOOCs - such as those gathered in the table below - which however, fail to focus really on the importance of the digital turn for sustainable heritage work.

Table 2: Examples of MOOC

MOOC Title	Platform	Institution	Obectives/Focus
Digital Education with Cultural Heritage[9]	European Schoolnet Academy	EF - Europeana Foundation	Provide insights into educational potentials of digital cultural heritage

[7] https://www.kuleuven.be/onderwijs/werkvormen/activeren_studenten/ABCdesign/onderwijs-anders-bekeken

[8] The MOOCs "Europeana Space: Creative with Digital Heritage" (EU CIP Funded), "Creating a Digital Cultural Heritage Community" (EU CEF Funded) and "Euro Noir: Cultural Ientity in European Popular Crime Narratives" (Horizon 2020 Funded), all available on https://www.edx.org/school/kuleuvenx.

[9] https://www.europeana.eu/en/europeana-classroom/moocs

MOOC Title	Platform	Institution	Obectives/Focus
			Guide the teachers to integrate digital cultural heritage in their classes
Cultural Heritage in Transformation[10]	edX	RWTH Aachen University	Management of tangible Cultural Heritage Does not cover digital transformation in the institutional context
Arts and Culture: Towards a New Management Paradigm[11]	edX	IIMBx - Indian Institute of Management, Bangalore	Economics approach Not focused on the implications of digital transition.
Arts and Heritage Management[12]	Coursera	Bocconi University, Milan	Focused on "art management", and networking.
Tourism Management at UNESCO World Heritage Sites[13]	FUN MOOC	Université Paris 1 Panthéon-Sorbonne	Focused on communication technologies, economy, management and planning

5. The InDICEs MOOC

The MOOC "Developing Digital Transition Strategies for Cultural Heritage Institutions", hosted on the KU Leuven's edX platform - KULeuvenX[14] brings together the main results of the research and analysis conducted in the past three years within the inDICEs project.

Developed through a robust cooperation between inDICEs partners and specialists as well as experts from the KU Leuven MOOC development team, the course aims to raise awareness of the potential of digital transformation strategies for cultural heritage institutions. Professionals from the cultural heritage sector and academics are guided in the discovery of methods and tools, which can help them better navigate the digital transformation realm.

The course revolves around six modules, each of them dedicated to relevant topics within the field of digital transformation for cultural heritage institutions. Each module represents a step towards a better understanding of the challenges as well as the possibilities that digital transition strategies can offer to cultural institutions. Participants are invited not only to build their comprehension of the concept of digital transformation and its potential for the cultural sector, but also - thanks to the implementation of dedicated discussion forums within the learning environment - they are encouraged to share their experiences and actively discuss with the other participants.

Thus, from an educational point of view, the MOOC is envisioned not only as a traditional learning environment that allows participants to expand their knowledge on the topic but also as a place of professional growth. Through focused exercises, readings, video conversations, practical examples and the presentation of currently relevant case studies, the learners are encouraged not only to immediately put into practice their newly acquired knowledge but also to question their previous habits and assumptions and understand how to face new challenges.

The course aims to exploit the many potentialities of a distance learning environment by creating a consistent learning experience but also encouraging engagement and participation. In this context, the following elements

[10] https://www.edx.org/course/cultural-heritage-in-transformation
[11] https://www.edx.org/course/arts-and-culture-towards-a-new-management-paradigm
[12] https://www.coursera.org/learn/arts-heritage
[13] https://www.fun-mooc.fr/en/courses/?limit=21&offset=0&query=heritage
[14] https://www.edx.org/school/kuleuvenx

contributed to the design of a distance learning course that could support and enhance the above-mentioned educative structure at the basis of this MOOC:

- **Adoption of an instructor-paced learning environment.** Instructor-paced courses are generally offered in edX courses as an alternative to self-paced courses, which allows students to access immediately at the time of enrolment all the material offered in the MOOC and to work at their own pace until the end date. Differently, instructor-paced courses enable students to set a fixed learning schedule that learners need to follow systematically in order to complete the MOOC. The material contained in each module is released on a weekly basis. This method not only encourages students to follow the course methodically but also facilitates dialogue and discussion among the participants, reducing the risk of lack of participation.
- **Possibility to create a personalised trajectory.** Although the sequence of modules is harmoniously structured and the following of a certain order is suggested, each module is also designed to exist independently of one another. This enables MOOCs participants to create their own learning trajectory and to freely choose the modules to follow depending on their own needs and interests.
- **Use of external tools to expand users' learning experience.** Participants' learning experience is not confined within the edX environment -as it traditionally happens in the MOOCs developed on edX - but extended outside the learning platform by the inclusion of content and activities redirecting to external tools such as the inDICEs Self-Assessment-Tools, the Europeana Impact Playbook or the Visual Analytic Dashbord (VAD) developed in the context of the inDICEs project . The combination of different environments aims not only at supporting a diversity of activities but also at upgrading the learning experience with further interactive elements.
- **Blended-learning.** Besides being worldwide available on the edX platform for all the students interested in the topic, the course is also designed to be included within a blended learning environment in the context of dedicated digital cultural heritage courses offered at KU Leuven.
- **Conversations with the experts**. A further element that was used to support learners in their understanding of digital transitions strategies and challenges for the cultural heritage sector, is represented by the video interviews with professionals coming from various European cultural institutions available in each module of the MOOC. From an educational point of view it was essential that students would also learn directly from experience professional figures in the sector.

6. Conclusion

In this paper, we presented the choice for and the development of a research-project based MOOC on Digital Transformation for the Culture Heritage sector, in particular GLAM institutions. We argued the need for encompassing digital strategies for GLAM institutions, that also take an outside-in point of view, giving stakeholder communities a voice in inside digital processes. We detailed the actual research project in which this MOOC was developed, which focuses on the way heritage institutions should relate their activities to new modes of cultural production, redefine their mission to adapt to the possibilities of the digital and develop and monitor indicators in that regard. We discussed the reasons for academic institutions to develop such MOOCs, as well as the reasons for GLAM institutions to participate in such MOOC projects. We explained the previous experience that enabled us to do so, gave an overview of the MOOC that was produced, and attached some lessons learned. With this research project, we aimed to highlight on the one hand how the use of a MOOC format as a learning alternative can possibly strengthen the stakeholders relations and professional network embedding. On the other hand we expect to provide an example of how the integration of different MOOC approaches can work towards a participative learning formats.

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References

A conversation starter: towards a common definition of micro-credentials | VOCEDplus, the international tertiary education and research database (2021). Available at: https://www.voced.edu.au/content/ngv:91634 (Accessed: 5 September 2022).

Amalia, J., and Hanika, I. (2021) "Tourism in Digital Era: The Influence of Digital Marketing on the Intention to Visit Museum", Malaysian Journal of Communication 37, No. 3. https://doi.org/10.17576/jkmjc-2021-3703-16

Boud, D. and Jorre, de S.J.T. (2021) "The move to micro-credentials exposes the deficiencies of existing credentials", Journal of Teaching and Learning for Graduate Employability, 12(1), pp 18–20. Available at: https://doi.org/10.3316/informit.961666297767751

Boullier, D., (2012) "The MOOCs fad and bubble: Please tell us another story", Inside Higher Ed. Available at: https://www.insidehighered.com/blogs/globalhighered/moocs-fad-and-bubble-please-tell-us-another-story

Davies, R. (2020) "Crowdsourcing in Cultural Heritage", Zenodo, December 30. https://doi.org/10.5281/zenodo.5244792

Daniel, J. (2012) "Making Sense of MOOCs: Musings in a Maze of Myth, Paradox and Possibility" Journal of Interactive Media in Education, Vol. 3, p. Art. 18. http://doi.org/10.5334/2012-18

De Voldere, I., Romainville, J., Knotter, S., and Durinck, E. (2017) "Mapping the Creative Value Chains : A Study on the Economy of Culture in the Digital Age : Final Report", Website. Publications Office of the European Union, May 30. https://op.europa.eu/en/publication-detail/-/publication/4737f41d-45ac-11e7-aea8-01aa75ed71a1

Fernandez-Lores, S., Crespo-Tejero, N., and Fernández-Hernández, R. (2022) "Driving Traffic to the Museum: The Role of the Digital Communication Tools", Technological Forecasting and Social Change, Vol. 174, (Jan). https://doi.org/10.1016/j.techfore.2021.121273

Holton, D. (2012) What's the "problem" with MOOC? EdTechDev. Developing EducationalTechnology. URL: http://edtechdev.wordpress.com/2012/05/04/whats-the-problem-with-MOOC/

Janssens, M.C., Gorbatyuk, A. and Pajares Rivas, S. (2021) "Deliverable 2.1: Mapping of the relevant European IP legal framework", Zenodo. https://doi.org/10.5281/zenodo.5141439

Janus, A., Tarkowski, A., Strycharz, J., Drabczyk, M., "Deliverable 3.1: Policy analysis of value chains for CHIs in the Digital Single Market", Zenodo. https://doi.org/10.5281/zenodo.5140001

Mas, J. M., and Monfort, A. (2021) "From the Social Museum to the Digital Social Museum", ADResearch: Revista Internacional de Investigación En Comunicación, No. 24, pp 8–25.

Mary Queen, V., & Vel Murugan, P. (2020) "MOOCs as a Digital Learning Platform" Sparkling International Journal of Multidisciplinary Research Studies, 3(1), pp. 28-37.Murugan, P. & Queen, V. (2020) "MOOCs as a Digital Learning Platform", International Journal of Multidisciplinary Research Review, No. 3, pp 28-37. doi:10.1080/02763869.2014.866490

McGreal, R. and Olcott, D. (2022) "A strategic reset: micro-credentials for higher education leaders", Smart Learning Environments, 9(1), p. 9. Available at: https://doi.org/10.1186/s40561-022-00190-1

Petrescu, M., and Krishen, A. S. (2020) "The Dilemma of Social Media Algorithms and Analytics", Journal of Marketing Analytics 8, No. 4, pp 187–88. https://doi.org/10.1057/s41270-020-00094-4

Ryan, T., Allen, K. A.,. Gray, D. L., and McInerney, D.M. (2017) "How Social Are Social Media? A Review of Online Social Behaviour and Connectedness", Journal of Relationships Research 8. https://doi.org/10.1017/jrr.2017.13

Sacco, P. L., Ferilli, G., and Tavano Blessi, G,. (2018) "From Culture 1.0 to Culture 3.0: Three Socio-Technical Regimes of Social and Economic Value Creation through Culture, and Their Impact on European Cohesion Policies", Sustainability 10, No. 11. https://doi.org/10.3390/su10113923

Sacco, Pier Luigi, De Domenico, Manlio, Artime, Oriol, Tartari, Maria, & Pilati, Federico. (2021). Deliverable 1.3: Report on data gathering V.1. Zenodo. https://doi.org/10.5281/zenodo.5141542

Schroeder, J. E. (2021) "Reinscribing Gender: Social Media, Algorithms, Bias", Journal of Marketing Management 37, No. 3–4, pp 376–78. https://doi.org/10.1080/0267257X.2020.1832378

Siemens, G. (2005) Connectivism: A learning theory for the digital age. International Journal of Instructional Technology and Distance Learning, 2(1), pp. 3–10.

Sofaer, J., Davenport, B., Stig Sørensen, M. L., Gallou, E., and Uzzell D. (2021) "Heritage sites, value and wellbeing: learning from the COVID-19 pandemic in England." , International Journal of Heritage Studies 27, pp. 1117 - 1132.

Tanner, S. (2020) Delivering Impact with Digital Resources: Planning Your Strategy in the Attention Economy, Facet Publishing.

Tanner, S. (2012) Measuring the Impact of Digital Resources: The Balanced Value Impact Model, King's College London.

Truyen, F., Bočytė, R. (2021) "Deliverable 3.2: Guidelines for CHIs Digital Transformation", V.1, Zenodo. https://doi.org/10.5281/zenodo.5666910

Waller, D. R., Douglas, K. A., Nanda, G. (2009) "A Case Study of Discussion Forums in Two Programming MOOCs on Different Platforms", American Society for Engineering Education.

Wang, Z., Anderson, T., Chen, L., & Barbera, E. (2017). "Interaction pattern analysis in cMOOCs based on the connectivist interaction and engagement framework", British Journal of Educational Technology, 48(2), pp. 683–699. https://doi.org/10.1111/bjet.12433

Wheelahan, L. and Moodie, G. (2021) "Analysing micro-credentials in higher education: a Bernsteinian analysis", Journal of Curriculum Studies, 53(2), pp 212–228. Available at: https://doi.org/10.1080/00220272.2021.1887358

New Kids on the Block? Exploring Technological Preferences of a New Generation

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Abstract: Over the past decades, reported research have continuously alluded to the impact of "digital natives," "millennials," and a range of reported "generations," and warned about the need to adapt across all spheres, including education, educational approaches and student support. Higher education akin to these demands. Contemporary trends in student styles indicate an ever-expanding preference in using digital options. In essence, the use and application of technology and expectations hereof are changing with the emergence of each new generation. This necessitates a deepening in understanding, of inter alia, developments and application of educational technology and instructional design. With the disruptive technological changes of the Fourth Industrial Revolution (4IR), a new entry-level student, characterised by an increased digital imprint and a marked preference to using only mobile technology, surfaced and is already coined in literature as "the phygital generation". Phygital is the concept of using technology to bridge the digital world with the physical world with the purpose of providing a unique interactive experience for the user. The term has first been introduced by the marketing and consumer industries. Here, smart and mobile technologies enable interaction and experiences for increasingly daily needs such as online purchases, traveling, learning, communication. The question is: how does this new trend affect teaching and learning? Evidently, students from this generation prefers to learn from microcontent and they are averse to voluminous content. Is there an understanding of the nature of the phygital generation, with its focus on mobile technology? Will this exacerbate the digital divide in marginalised communities? Framed by Critical Pedagogy, this paper interrogates the knowledge that a group of lecturers and their support staff in a Higher Education Institution in South Africa must accommodate a new generation of students. Using an interpretive design, qualitative data were collected from a purposively selected group of educators and support staff. Semi-structured interviews were used in this case to gauge their awareness and readiness to accommodate this new generation in their teaching and learning ecosystem. Findings are that participants are aware of the change but are not prepared for contemporary trends. Informed by critical theory, the paper offers critical indicators to address the gap.

Keywords: agency, the phygital generation. mobile technology, micro learning, critical digital pedagogy

1. Introduction and background

One of the African Union's flagship projects on the Africa 2063 Agenda is the use of technology-assisted teaching and learning to increase access to tertiary and continuing education in Africa (AU, 2021). This objective links with the United Nations' 2030 Sustainable development Goals, SDG4, aiming for inclusive and equitable quality education and the promotion of lifelong learning opportunities for all. Higher Education Institutions (HEIs) have continuously been challenged by new technological developments. However, studies allude that many HEIs in Africa are still following traditional teaching and learning approaches (Van Wyk, 2020; Kunda, Chembe, & Mukupa, 2018). HEIs must prepare to navigate disruptive changes by, inter alia, exploring the affordances of mobile learning offering microcontent. To compound this complex scenario, the prevailing digital exclusions experienced by many students, in especially Africa, could potentially increase. This study firstly asks if the HEI selected, observed the said emerging new trend. And secondly asks: what is being done to accommodate the new trend?

At the backdrop of a prevailing digital divide, in a particularly on the African or southern African context, the value of Critical Realism paradigms and the affordances of critical theory must be revisited. Informed by recent reported research, this study explores the lived experiences in a Higher Education Institution (HEI) in South Africa in identifying and accommodating the new generation. The factors that could potentially exasperate an existing digital divide within rapid developments are explored. The readiness of universities to rise to the new demands is investigated and gauging existing competencies to understand the extent and nature of potential gaps in skill sets. Taken the high mobile penetration in Africa, it makes sense that the solution lies in exploring the value of mobile technology in teaching and learning.

2. The Identification of a new generation

Retail and marketing were the first sectors to respond to the unique needs of the new generation. Realising this change, online advertising and purchasing options adapted very effectively to this change in behaviour. This new term and phenomenon can be described as the phygital generation. Coined around 2013 (Mele, C. *et al.* 2021)

this term applies to a new generation of students who prefer to navigate all aspects of their world via their smart devices. The term phygital refers to the joint environments of the physical lived experience and the digital lived experience. One completely emerged in blending the physical world with the online, experiencing life by seamlessly integrating two worlds via mobile technology and social media.

Dimock (2019) explains the value of classifying generations to be used as a tool to research and analyse changes over time. Functioning in a ubiquitous digital world has changed "Generation Z" or "iGen" to the extent that a new generation is emerging, coined in literature as "the phygital generation". It could be argued that the phygital student exists in a post digital world. Jandric (2020) explains the age of the postdigital as a blurring of lines between the physical and virtual worlds, where the one can no longer exist without the other:

> *"We are increasingly no longer in a world where digital technology and media is separate, virtual, 'other' to a 'natural' human and social life" (Jandric, 2020: 178).*

Reportedly, this generation sees little distinction between the physical and digital worlds and appears to be comfortable in both (Mele, C. *et al.* 2021, Mikheev, A. A. *et al.* 2021).

2.1 Characteristics of the phygital generation

Not much has been written on the phygital generation in higher education, but authors (including Mele, C. *et al.* 2021, Mikheev, A. A. *et al.* 2021) report that the phygital generation display the following characteristics and behaviour:

- Interpersonal, interaction and collaborative experiences are important;
- Access versus ownership is preferred;
- Immediacy in answering needs;
- Seamless immersion between the physical and the digital world is expected.

All the above reported preferences are facilitated by mobile technology and services.

3. Technology integration in teaching and learning

The nature and impact of mobile technology on the demands of this generation were underestimated by HEIs. Mobile technology is at the centre of the phygital generations' preferences and includes studying and accessing information sources and libraries.

Literature abounds that mobile phones and smartphones are increasingly utilised by students to access services on the internet. Among the emerging technologies, mobile communication technology is growing at a rapid speed (Coker, 2020). Lunevich (2021) posits on the role of the educator's competencies and skills to include the capacity to plan, initiate, lead, and develop education and teaching to be cognisant of students' digital skills or gaps thereof. Mobile learning has been accepted as part of academic, but meaningful integration towards inclusive education and equity in delivery still has a long way to go. These devices include smart phones, tablets, e-book readers, handheld gaming tools and portable music players.

The penetration of mobile connectivity in Africa is higher than internet connectivity (GMSA 2020). This makes mobile devices ideal to facilitate learning. In addition, the familiarity with their own devices and technology helps the users in accessing information quickly and does not require orientation and training in accessing library resources (Gandotra, 2019). Mobile services include mobile-friendly websites or apps, mobile-friendly access to the library's catalogue and online databases, text messaging services, e-books, and LIS tutorials available via mobile devices.

3.1 Metacognition, microlearning and microcontent

In its simplest form, metacognition is thinking about thinking. Metacognition implies that students can monitor their own performance and are equipped to know their information and learning needs. The phygital generation is more comfortable with microcontent, rather than lengthy readings.

> *"Microlearning allows for the breakdown of complex topics and deliver new training and reinforcement activities in brief sessions" (Dillon 2019).*

Learning is optimised when distributed in manageable portions, opposed to it being delivered in one long continuous session.

3.2 Metacognition and metaliteracy

Metaliteracy emphasises four learning domains: the cognitive, behavioural, affective, and metacognitive. Mackey and Jacobson (2016) state that metaliteracy forms the foundation of a range of literacies including visual literacy, digital literacy and media literacy, among others. As conceptual framework for information literacy it enables the construction of networks, supports lifelong learning and literacy fluency. As such, metaliteracy combines the cognitive, behavioural, procedural, and motivational, and other practices towards more context-specific and context-appropriate practices. Fulkerson, Ariew and Jacobson (2017) add that metaliteracy focuses on metacognition as well as the realisation that students are indeed creators of information during research and learning.

3.3 Critical pedagogy and student agency

Morris and Stommel (2017) stress that Critical Pedagogy is an approach to teaching and learning, focussed to develop student agency in an environment where oppressive structures should implicitly and explicitly be criticised. Morris and Stommel (2017) explain that the essence of Critical Pedagogy lies more in the deprived effect of not-knowing, opposed to knowing, referring to students and educators alike. The new generation of students requires positioning, where they can be acknowledged, respected and empowered in an already challenging digital world. Williams (2017) stresses that learning with agency is an entirely different cognitive and physical activity leading to powerful learners who choose to take on challenges with their whole being. Stenalt (2021) opines that where student agency generally referred to sociocultural aspects of student experiences, in a digital world this definition needs to be expanded to allow temporally constructed engagement of digital and networked environments.

4. Research design and frame: A critical frame for a critical problem

Coker (2021) posits that critical pedagogy is intricately linked to the concept of the postdigital era, where the emphasis is no longer on emerging technologies, but where the so-called “disruptive technologies” are actively being implemented and used extensively. The concept of critical digital pedagogy must be explored further in African Higher Education. Jandric (2020) points out this era is characterised by the fact that the human competencies are as important as the computational and technological functionalities. Knox (2019) warns that a postdigital approach makes it virtually impossible to divorce pedagogy from technology. Waddle and Clariza (2018) take this further and stress that Critical Digital Pedagogy necessitates a networked educational environment and warns that going about outdated practices of supporting students with repositories of content alone, is bound to fail.

5. Rationale of the study

The aim of this study is to explore academic and academic support staffs’ experience and awareness of a new generation student. This study explores the value of critical realism paradigms in approaching prevailing and new forms of digital exclusion of students. Informed by critical theory, qualitative data were collected from semi-structured interviews in a technologically marginalised community of students. Using an interpretive design, qualitative data were collected from a purposively selected group of educators and support staff. The non-probability sample was purposively selected, consisting of academic support service’s staff and eleven lecturers teaching a new cohort of Psychology students attending hybrid classes, which is a mix between face-to-face classes and eLearning on the learning management system.

6. Analysis, presentation, and discussion of findings

The qualitative data collected during the interviews were analysed using thematic reflective analysis. Vaismoradi *et al.* (2016) state that qualitative research, as a group of approaches for the collection and analysing data, aims to provide an in-depth, socio-contextual and detailed description and interpretation of the research topic.

The data collected form the interviews were transcribed and thematically analysed. All participants, both from the support services and from lecturers confirmed a marked shift to mobile preference. The following themes were identified:

- New student behaviour and preferences

- Networking, online presence and collaboration
- The need for metacognition and metaliteracy
- Support towards digital equity and cognitive justice
- Student agency in a networked education environment

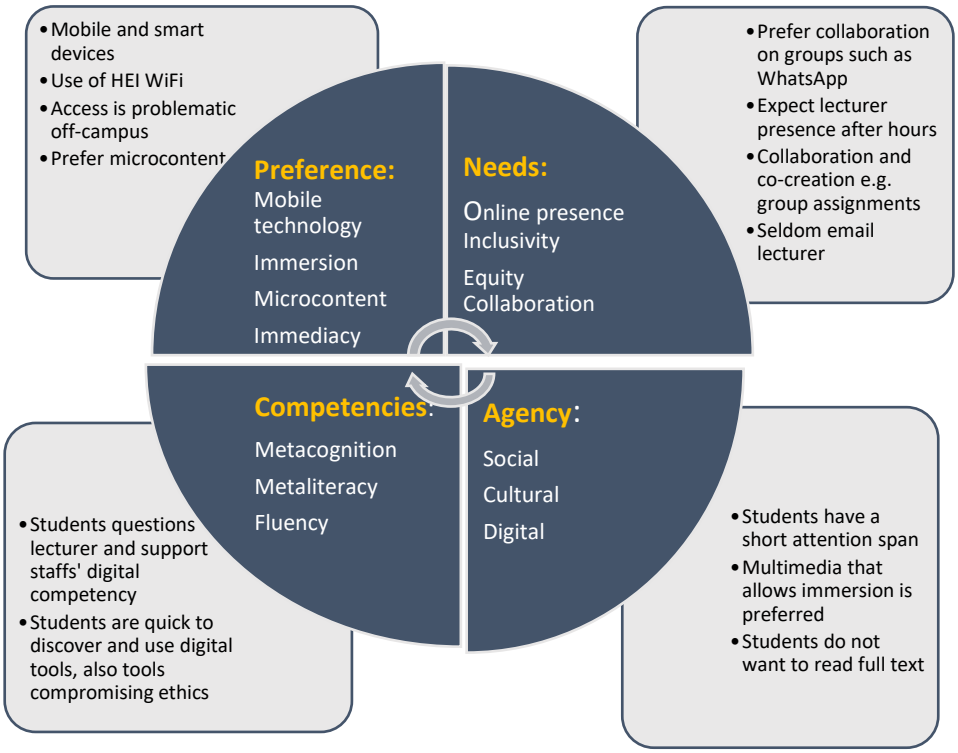

Figure 1: Themed presentation of findings

Findings are that there is a pronounced shift observed in the learning and accessing information by new entry students compared to previous cohorts. Reported observations allude to the propensity towards using mobile technology in all aspects of daily activities. Over and above the reported preference to mobile technology use, the phygital student prefers to network and share information with fellow students using online applications such as WhatsApp. They expect to access all support services and communication with their Smart Devices.

The study found that participants are acutely aware of the preferences of new student cohorts. Some participants conceded to encourage students not to use mobile technology, and to remain with the mainstream and traditional teaching and learning practices.

> *"My main focus is on the course content of my discipline. This is also how I teach…I know truly little about mobile use in the classroom, and I find it is a hindrance" (Participant F).*

Although participants understood the role of cognition in its traditional sense, a shift is beckoning towards a deeper understanding to be able to embed constructs of metacognition, metaliteracies as well as cognitive justice in the curricula, and as teaching and learning praxis to accommodate a new generation.

Evidently, the participants, being academics and academic support staff, feel overwhelmed and unprepared to answer to the demands of students. Participants further reported an observed lack of metaliteracies, including digital fluency required for student success. Writing skills are lacking:

> *"I have recently noticed that students writing styles in assignments are short and curt. At times it is like the style they use to SMS or text" (Participant C)*

Although the changed student behaviour is confirmed by this study, it is evident that the participants are not fully equipped to address the new demand. The study revealed the urgent need for a better understanding among participants of the pedagogy and praxis in a changed ecosystem. On a question around developing student agency participants voiced their understanding of learning through activities that are meaningful and relevant to learners but providing opportunities akin to the new generation students' interests posed problems:

> *"I sometimes find it difficult to keep them interested and engaged, they seem to get bored very easily" (Participant A)*

Participants believed that students have limited choice on how to their learning takes place. They further reported that students prefer personalised learning, which was not always possible. Participant reported that even though the HEI professes to offer student-centred teaching and learning the current central development of course material, and the instructional designs on the current LMS do not in all cases allow for student agency and personalised learning.

Participants reported that if students could access resources on campus, but the inequality became evident during the pandemic lockdown period from 2020 to 2021, where data costs and access became a hurdle in student success.

7. Recommendations: Indicators towards improved critical digital agency

The study alluded to the importance of digital fluency for academics and the need to continuous reskilling and upskilling to support student agency. According to Stenalt (2021) where teaching with technology is concerned, digital agency must be developed and supported. Here, digital agency entails digital competencies, digital confidence, self-reliance and digital accountability to function in a connected environment. Addressing these shortcomings, the widening of the digital divide and in an already marginalised group, can be addressed. Critical digital pedagogy in HE for the African HE, require an urgent re-evaluation and intervention on institutional level. Continued retraining and reskilling of educators must address skills gaps with the needs of the new generation in mind. Freire's (1972) stance that pedagogy is never neutral, has once again proven to be critically important, also for this study. Teaching towards delivering future-ready students and citizens beg a change in curricula and instructional design to include theory and practice of critical digital pedagogy and digital agency. Indicators include:

- Teaching and learning must use technology that facilitates the nature of the phygital student;
- Metacognitive and metaliteracy strategies must form the foundation in preparing learning;
- Developing agency must address social justice, inclusion and digital equity;
- The integration and adjustment of instructional design and agency-support services to accommodates phygital needs and behaviour, and to strengthen engagement.

Critical teaching strategies, the integration of digital tools and information sources must enable students to become creators of new information.

8. Conclusion

A new generation student is emerging from Generation Z and is characterised by an ever-expanding digital imprint. This study explored the preferences of new entry-level students as perceived and observed by their lecturers and support staff. Not surprisingly, the rapid and disruptive technological changes imposed by the 4IR resulted in an entry-level student cohort with different learning and information seeking trends and expectations. This case study concluded that there are similarities in technology preferences as those reported in retail and marketing research. However, the similarities are brief as it may be less complex to do online purchases than online learning. Digital student agency is far more complex.

In answering the two research questions, this study confirms that the new generation has a marked preference and expectation towards using mobile technology to navigate all aspects of their daily lives, including research and study. Findings are that participants, (being educators, academics and academic support staff) are not prepared to accommodate the phygital student. The study also warns that potential digital exclusion, the metacognition and metaliteracy required to function and succeed in a connected teaching and learning ecosystem do not only affect students. It starts with cognition and metacognition amongst lecturers, support staff and all HEI sectors.

Student agency in a changing digital world must be created with a sensitivity of cognitive justice of the social and cultural lived experience of students and broaden these constructs to include digital aspects. "Culturally relevant pedagogy also calls for students to develop critical perspectives that challenge societal inequalities" (Lunevich, 2021: 2011). Learning must be student-centred, and it is invariably political and subjective (Morris and Stommel, 2017).

As a qualitative study, the findings cannot be generalised and further research on the agency of the phygital generation is needed. Much more needs to be done to use mobile technology towards better inclusivity and effective learning design. It must become strategic foci in HEIs to capitalise on the affordances of mobile technology and the student-driven integration of resources and digital tools. HEIs need to rethink their metacognitive strategies to create student agency. The phygital student must be empowered to function in the 4IR and to think about their own thinking. HEIs are often ill-equipped to live up to international agendas and governments policies. Where initiatives such as the AU's 2063 agenda do not translate to foot sole level of education, these goalposts will keep on being moved. Only then will they be able to enhance motivation and control over their own deep learning, critical thinking and creative problem solving.

References

African Union (AU) (2021) African Agenda 2063: National Development Priorities, 31 January 2021 [Online] https://au.int/en/videos/20210131/agenda-2063-national-development-priorities

Coker, H. (2020). 'Why Does Digital Learning Matter? Digital Competencies, Social Justice, and Critical Pedagogy in Initial Teacher Education', *Journal of Teaching and Learning*, 14(1), pp.133–141

Dillon J. D. 2019. The Science behind Microlearning Effectiveness, *Training & Development (1839-8561)*, 46(4), pp. 14–16.

Dimock, M., (2019). 'Defining generations: Where Millennials end, and Generation Z begins.' *Pew Research Center*, *17*(1), pp.1-7.

Freire, P. (1972). *Pedagogy of the oppressed*. [New York], Herder and Herde.

Fulkerson, D. M., Ariew, S. A. and Jacobson, T. E. (2017). 'Revisiting Metacognition and Metaliteracy in the ACRL Framework,' *Communications in Information Literacy*, 11(1), pp. 21–41.

Gandotra, N. (2019). 'Mobile Based Library Services,' *International Journal of Applied Marketing & Management*, 4(2), pp.18–21.

GMSA Mobile Connectivity Index (2020). https://www.gsma.com/r/wp-content/uploads/2020/09/Mobile-Internet-Connectivity-SSA-Fact-Sheet.pdf

Jacobson, T.E and. Mackey, P.K., (2016) '*Metaliteracy in Practice'*. Chicago: ALA Neal-Schuman.

Jandric. P. (2020). The Post Digital Challenge of Pandemic Education. *Journal of Contemporary Educational Studies,* 71(137).

King, R. (2011). 'Metacognition: Information Literacy and Web 2.0 as an Instructional Tool,' *Currents in Teaching & Learning*, 3(2), 22–32.

Knox, J. (2019). 'What Does the 'Postdigital' Mean for Education? Three Critical Perspectives on the Digital, with Implications for Educational Research and Practice.' *Postdigit Sci Educ* **1,** pp**.**357–370 (2019). https://doi.org/10.1007/s42438-019-00045-y

Kunda, D, Chembe, C, and Mukupa, G. (2018). 'Factors that influence Zambian higher education lecturer's attitude towards integrating ICTs in teaching and research.' Journal of Technology and Science Education, [S.l.], 8 (4) pp. 360-384, July 2018

Lunevich, L. (2021). 'Critical Digital Pedagogy and Innovative Model, Revisiting Plato and Kant: An Environmental Approach to Teaching in the Digital Era.' *Creative Education*, **12**, pp.2011-2024. doi: 10.4236/ce.2021.129154.

Martin, A and Felix, E, (2020). 'How COVID-19 is Creating Phygital Experiences with Technology as the Interface Between People and Space'. [Online].: https://www.brightspotstrategy.com/covid-19-phygital-experiences-technology/

Mele, C. *et al.* (2021) 'The millennial customer journey: a Phygital mapping of emotional, behavioural, and social experiences', *Journal of Consumer Marketing*, 38(4), pp.420–433. doi: 10.1108/JCM-03-2020-3701.

Mikheev, A. A. *et al.* (2021). 'The Interaction Model within Phygital Environment as an Implementation of the Open Innovation Concept,' *Journal of Open Innovation*, 7(2), pp. 114. doi: 10.3390/joitmc7020114.

Morris, S.M. and Stommel, J. (2017). 'Open education as resistance: MOOCs and critical digital pedagogy, MOOCs and their Afterlives: Experiments in Scale and Access in Higher Education,' 177.

Roten, Y. S. and Vanheems, R. (2019). 'Which screens to share in stores with which customers?,' *Journal of Marketing Trends (1961-7798)*, 5(3), pp.25–36.

Stenalt, M. (2021). 'Digital student agency: Approaching agency in digital contexts from a critical perspective,' ***F****rontline* ***L****earning* ***R****esearch,* 9(3) pp. 52 - 68

Vaismoradi, M., Jones, J., Turunen, H., and Snelgrove., S. (2016). 'Theme development in qualitative content analysis and thematic analysis, Journal of Nursing Education and training,' 6(5), pp.100-110.

UNESCO (2017) 'UNESCO: moving forward the 2030 Agenda for Sustainable Development', [Online] https://en.unesco.org/creativity/sites/creativity/files/247785en.pdf

Van Wyk, B. (2020). 'How Lecturers in a Faculty of Education at a Sub-Saharan Private Online Distance Higher Education Institution Use Digital Technologies for 21st Century Teaching and Learning', (Masters Dissertation) University of Johannesburg

Waddell, M. and Clariza, E. (2018). 'Critical digital pedagogy and cultural sensitivity in the library classroom: Infographics and digital storytelling,' College & Research Libraries News, 79(5), pp. 228–232. doi: 10.5860/crln.79.5.228.

Applying Low-Cost Sensors to Improve Students' Blended Learning Experience During the Pandemic

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Abstract: The Covid-19 pandemic has caused unprecedented disruption to global education. In particular, the laboratory and field teaching has been heavily affected by the pandemic due to the implementation of lockdown and social distance. Schools and universities had to take urgent and necessary measures to transform traditional face-to-face education to online or blended mode. Most of the measures are concentrated on tool-based pedagogy, and instructors use nearly all available tools, primarily digital tools, for example, Zoom and MS Teams, to maintain the continuation of education. The online learning, through lecturing and supervising of some processes, can build up students' theoretical aspect (knowledge), but students' practical skills have been little developed. Given the advantage of the Internet-of-Things (IoT), low-cost sensors have been increasingly used for direct measurement without laboratory support, while their application in teaching and learning has been little explored. In this case study, a low-cost air quality sensor, PlumeLabs Flow 2, was applied in blended learning of undergraduate Environmental Science/Engineering programmes. With some lectures on environmental pollution knowledge, students studied in teams (Team-Based Learning) using low-cost sensors to measure air quality and developed projects (Project-Based Learning) to mitigate environmental pollution. Survey and interviews were conducted to understand students' learning experience and identify suggestions for further improvement of this kind of blended learning. The survey and interviews indicate that more than 90% of students praised the positive effects of this new technology-enhanced learning, including improvements in skills and employability. Especially, students emphasized the advantage of learning knowledge and developing practical skills without relying on laboratory, which was very difficult or impossible during the pandemic. One of the concerns of low-cost sensors is the possible bias of the measurement data. Thanks to the rapid advance during the pandemic, online and blended learning will continue to develop in the post COVID-19 era. Using low-cost sensors will be an important approach to compensate for the lack of training of practical skills in blended and online education.

Keywords: blended learning, low-cost sensor, team-based learning, project-based learning, practical skills

1. Introduction

The rapid spread of coronavirus (COVID-19) has interrupted education systems in almost all countries. Like all organisations, universities had to instantly deal with the imminent threat from the unexpected and disruptive COVID-19 pandemic, so-called crisis management. Constrained by lockdown and social distance, universities had to take urgent and necessary measures to transform traditional face-to-face education, including field and laboratory teaching, into online or blended mode (Dhawan, 2020). The process-oriented strategy focuses on the impacts of the crisis on universities and the tasks required to perform to avoid or minimize such impacts. The term "crisis pedagogy", a crisis-aware education that includes the design and delivery of educational activities to better support learners through the crisis period (Khanal, 2021), is increasingly applied to illustrate the emergency online teaching and education task that was adopted to reduce the damage of the COVID-19 pandemic on university education. In general, crisis pedagogy consists of two parts: instructor-guided synchronous teaching and student self-paced asynchronous study. Most of the measures are concentrated on tool-based pedagogy, and instructors apply almost all available tools, mainly digital tools to continue teaching. As Nel and Marais (2020) have suggested, the appropriate teaching approach in this education crisis period should be process-based pedagogy, with the focus on how students access the study materials both safely and reliably.

For many programmes, such as Biology, Medicine, Geography, and Environmental Science/Engineering, the learning outcomes emphasize the significance of developing both theoretical and practical aspects (Gamage et al., 2020). In terms of establishing these practical aspects, students learn the field and laboratory methods and synthesise field observations and experimental practices. Field and laboratory teaching provide unique opportunities to develop students' design, analysis, problem-solving, data-recording, experimental, and practical skills (Davies, 2008). In a properly designed laboratory teaching session, students will become familiar with equipment and techniques. Learning under the supervision of teachers and in collaboration with classmates, students will be able to develop communication and interpersonal skills. By studying the real problem in the world, students can integrate learned theory with daily practice.

Most crisis pedagogy adopts an online education model. The online learning, through lecturing and supervising of some processes, can build up students' theoretical aspect (knowledge). The online learning has been increasingly used during the COVID-19 pandemic. These virtual sessions are helpful in increasing learners' understanding of knowledge, with the advantage of overcoming health and safety constraints (Lewis, 2014). However, online learning has obvious weaknesses that can affect the development of students' practical skills. Virtual laboratories, a computer-assisted learning environment which helps students perform experiments in a virtual learning environment using the computer-based interface, have developed rapidly during the COVID-19 pandemic (Kapilan et al., 2021). Notably, students still cannot directly use the equipment in the laboratory in the virtual laboratory environment, losing valuable hands-on exposure to these facilities and lacking the immersed learning experience in field and laboratory classes. The guideline for Practice and Lab-based Assessment from UK Quality Assurance Agency (QAA) states the learning outcomes need to include the assessment of competence and skill in using relevant equipment (QAA, 2020).

During the lockdowns and university closure period, instructors lack the luxury of physical tools and support, particularly laboratory and advanced equipment. For the crisis pedagogy during the COVID-19 pandemic, technology plays an increasingly important role in education, including remote and blended learning, at least offering learners access to new study materials. The new technological resources mainly used in the author's teaching include Zoom, MS Teams, Stream, Blackboard Ultra, Menti, Kahoot, and Padlet. Clearly, online education heavily relies on new technologies. After the partial lifting of the COVID-19 lockdown, students started to return to campus. However, 2-metre social distancing was still implemented in most study environments, especially laboratories. This limited laboratory capacity still constrained students' hands-on learning experience in laboratory.

In the last decade, the rapid development of the Internet-of-Things (IoT) and the maker movement promoted the accelerated advancement and wide application of low-cost electronic sensors (Chan et al., 2021). Portable and low-cost sensors are fostering appealing research opportunities. For example, low-cost bioacoustic sensors have been used to monitor wildlife and biodiversity (Teixeira et al., 2019). The build-it-yourself low-cost sensors provide opportunities to collect both spatially and temporally finer-scale data (Horsburgh et al., 2019). Low-cost sensors have also been used for large-scale hydrometeorological monitoring networks, for example, Trans-African HydroMeteorological Observatory (www.tahmo.org) and FreeStation initiative (www.freestation.org). One of the exciting advantages of low-cost sensors is that they allow direct measurement, without laboratory experiments using complicated equipment. Considering the impossibility of laboratory access during the COVID-19 lockdown period and reduced laboratory space due to 2-metre social distancing, this is extremely important. Despite their increasing popularity in research, low-cost sensors have been rarely used in teaching. In this research, a low-cost air quality sensor called PlumeLabs Flow 2 was used in the author's teaching.

Despite the importance of new teaching and learning tools, students' mental health students should never be ignored (Teräs et al., 2020). During the isolated online learning condition, students need a learning environment to interact with staff and other students more than ever before, with some sense of engaging with classmates and instructors like in an in-person learning environment. One of the aims of crisis pedagogy is to engage all learners during the education process by building up some sense of students' community, which has been proved to be crucial in mimicking the in-person study experience (Khanal, 2021). To create and maintain an active student learning community, the team-based learning (TBL) was applied in the author's teaching (Michaelsen et al., 2011). Students are divided into several small groups and conduct learning together, with proper social distancing.

The overall research question is "How did the application of low-cost sensors improve students' blended learning experience during the COVID-19 pandemic?". The main aims of the research are to 1) analyse the contribution of learning using low-cost sensors to developing students' practical skills; and 2) estimate the influence of learning using low-cost sensors on promoting a learning community during the pandemic. The results will be useful to understand the value of the recently developed low-cost sensors in blended learning, even in the post COVID-19 era.

2. Research methods

2.1 Pedagogic design

In this research, a low-cost air quality sensor Flow 2 was used in the author's teaching module Air Pollution and Urban Air Quality, with 27 students. Before the COVID-19 pandemic, students could easily access laboratories and conduct field and laboratory learning. However, online education, due to campus closure, ruled out the possibility of in-person field and laboratory learning. The blended learning began in September 2021, with the partial lifting of the COVID-19 lockdown, opened the opportunity for field class, while the 2-metre social distancing policy makes laboratory teaching still challenging. To overcome the difficulty, the low-cost Flow 2 sensor was applied in the author's teaching.

Students studied in small groups with 3 - 4 classmates in each team (Team-Based Learning) (Michaelsen et al., 2011) and ran 2-week small projects (Project-Based Learning) (Yang, 2021a) (Figure 1). Instead of learning in an indoor laboratory with a risk of coronavirus infection, students learn outdoors on the university campus, so-called the living laboratory (Lindstrom and Middlecamp, 2017). With some supervision, students proposed some projects on air pollution on campus. After reading some references, students developed project plans with detailed fieldwork and air quality measurements using the Flow 2 air quality sensor. With some guidance and demonstration from the supervisor, students carried out fieldwork and collected air quality data on campus using Flow 2 sensors (Figure 2). On the basis of the group data, each team delivered a group presentation, and all students completed their individual essays.

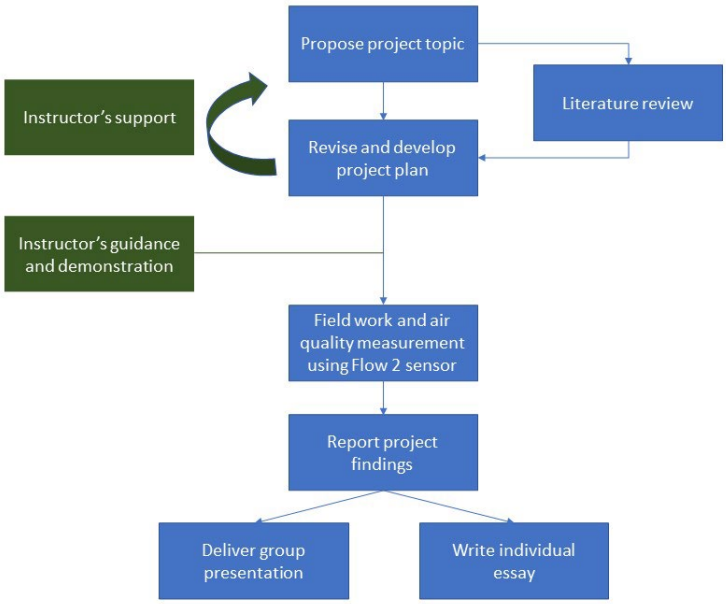
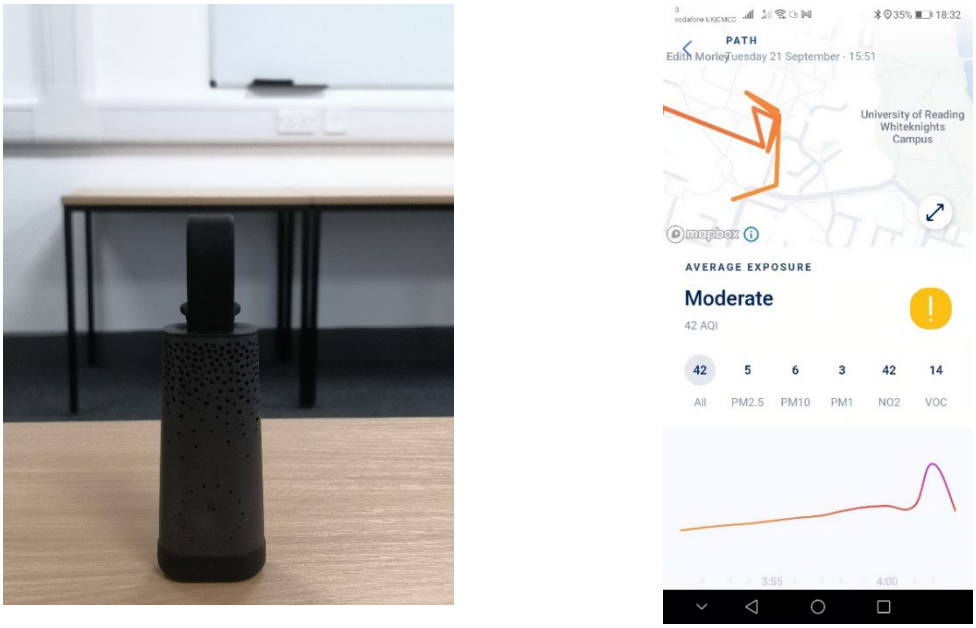


Figure 1: Pedagogic design of students' blended learning using low-cost sensors during the COVID-19 pandemic

2.2 Analysing students' learning experiences

To understand the learners' perception of the low-cost sensors and to evaluate the effectiveness of learning using the sensors, this research adopted both quantitative and qualitative methods for data collection. The online questionnaire (quantitative data) was conducted at the end of the module. The questions include students' opinions on learning methods, relevance to the real world, developing abilities as an independent learner, helping students to learn, creating a sense of belonging, providing adequate opportunities to interact with other students, and overall satisfaction. A total of ten students were interviewed separately for their feedback on teaching and learning (text, qualitative data). The descriptive statistics were conducted for the survey data (Loeb et al., 2017), and the thematic analysis method was used to analyse the qualitative data (Braun and Clarke, 2012).



(A) (B)

Figure 2: The low-cost air quality Flow 2 sensor was used in blended learning (A). The Flow App can directly show the air quality data and walking path (GPS location) on the phone, and the air quality data can be downloaded for learning (B)

3. Results

3.1 Quantitative data results

Figure 3 illustrates the questionnaire results for students' perception of learning using low-cost sensors. Around 93% of the 27 students confirmed having a positive learning experience using a range of teaching methods, particularly low-cost air quality sensors. Because students can measure air quality by themselves, the majority of the students thought their learning was relevant to the real world. Most students also confirmed that the new teaching method helped to "develop abilities as an independent leaner" and "help(ed) student to learn". During the COVID-19 pandemic, some students suffered from mental health problems (Yang, 2021b). Therefore, it is crucial to create a learning community, where students can study in small teams and help and support each other. Approximately 96% of the students agreed that this module had created a sense of belonging. The majority also confirmed that the module provided adequate opportunities for interaction. Overall, more than 90% of the students were satisfied with the entire module.

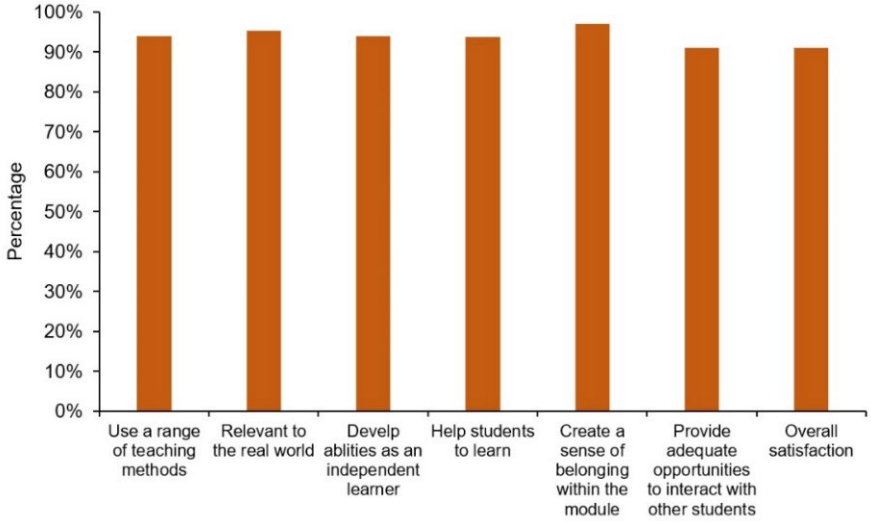


Figure 3: Students' perception (percentage) of learning using low-cost sensors during the Covid-19 pandemic

3.2 Qualitative data results

To make qualitative results more visible, two word clouds were created for two questions about the learning experience of using low-cost sensors (Figure 4) and team-based learning (Figure 5), based on the counts of the most used words. In Figure 4, sensor, flow, air, and data were mentioned frequently. In Figure 5, team, group, discuss, help, and data were mentioned frequently.

Figure 4: Word cloud of students' feedback on learning using low-cost sensors during the Covid-19 pandemic. Word cloud is in the shape of a graduation cap

Figure 5: Word cloud of students' feedback on team-based learning during the Covid-19 pandemic. Word cloud is in the shape of five hands, indicating learning together within the team

The thematic analysis identified three main themes from the qualitative data.

3.2.1 Students enjoyed learning using low-cost sensors

Similarly, learning using low-cost air quality sensors has received positive feedback from most studies, as emphasised by one student:

> *"The ability to use the air quality sensors to take our own data around campus is definitely a highlight."*

The sensors are new to all students. At the beginning, some students may worry about the difficulty of using them. However, after the demonstration, students started to like using it to learn air pollution. One student described his/her exciting experience as follows:

> *"On first consideration, I had preconceptions that they'd be high-tech and hard to control and use, and I had no clue how we were going to be measuring the data. When we were first introduced to them, all of my worries disappeared. They were so simple to figure out and had the most useful App on the phone to connect to and find all the data, and there were never really any problems with the collection."*

3.2.2 Learning using low-cost sensors improves students' professional skills and employability

For the Environmental Science/Engineering programme, it is crucial to equip students with practical skills through field and laboratory teaching (Davies, 2008). Despite the restrictions imposed by the COVID-19 lockdown and social distancing, the low-cost Flow 2 sensors can directly measure air quality, avoiding the risk of virus infection when studying in the indoor laboratory. Learning in the living laboratory, the university campus outdoors, students obtained practical skills, particularly, using sensors, that improved their employability. For example, one student explained:

> *"This project has also allowed me to increase my knowledge of using different equipment for needs, specifically air quality sensors. This is an important skill to learn as in my professional career, (as) I may need to use this type of data collection."*

3.2.3 Team-based learning using low-cost sensors creates a learning community

COVID-19 has seriously impacted many students, for example, the mental health problem during online learning, but learning using low-cost sensors in small groups has brought some positive changes to students' lives. One student exemplified this as follows:

> *"I believe working as a team for this project has had positive effects on both my studies and everyday life. Working as a team has given me the opportunity to collect and work with large amounts of data which I wouldn't have been able to collect if I was working alone. Working as a group has positively impacted my daily life as it has given me an opportunity to make new friends with similar interests which has been a challenging part of university so far due to COVID-19."*

Another student shared an enjoyable personal experience:

> *"I enjoyed working with my teammates and learnt new things from them as well. I also met new people."*

4. Discussion

The different types, models and teaching efficiencies of online and blended education have been researched in the last decade, particularly an increasing number of studies since the COVID-19 pandemic (Megahed and Hassan, 2022; Mulenga and Marbán, 2020; Murphy, 2020; Rose, 2020). In general, it is easier for theoretical subjects to transition to e-learning, but it is more challenging for other subjects with more laboratory and practical lessons (Krishnamurthy, 2020). Before the pandemic, online and hybrid education was rarely widely applied in Environmental Science/Engineering teaching, because of the strong tradition of field and laboratory teaching with hands-on experience. In a short period of time, the lockdown and partial lifting of lockdown later pushed the universities to conduct total online learning and blended learning afterwards. University staff had to deliver the new form of teaching with limited formal training. Importantly, new technologies and delivery modes need to align with study aims and produce a learning environment where students are able to build their own knowledge with hands-on experience (Megahed, 2014; Saghafi and Crowther, 2021). With the rapid development of ICT, integrating new technologies, such as portable sensors, can provide students the chance to engage in active learning and absorb the taught knowledge, based on their own practice (Chen and You, 2010; Crowther, 2013).

According to the technology integration matrix (TIM) (Jonassen et al., 2003), five technological integration levels (entry, adoption, adaptation, infusion and transformation) and corresponding five different study characteristics (active, collaborative, constructive, authentic and goal-directed) appear in the study process. The burgeoning of blended learning during the COVID-19 pandemic has already adopted, adapted, and infused

various digital tools, such as MS Teams and portable sensors in this study, in the continuum of teaching and study (Figure 6).

In the last two decades, technology, pedagogy and content knowledge (TPACK) model and a gradual release of responsibility (GRR) model have been increasingly applied in teaching (Figure 6). The TPACK model introduces the interaction among technology, pedagogy and content knowledge, and provides a framework to better facilitate the three basic components (Eutsler, 2022; Koehler and Mishra, 2005; Saudelli and Ciampa, 2016). The GRR model, with appropriate teaching and support, provides a scaffold of student learning responsibility and helps students develop to be an independent learner and explorer, thorough demonstration (instructor does and students watch), shared demonstration (instructor and students do together), guided practice (students do it and instructor watches/guides) and independent practice (Students do it alone) (Fisher and Frey, 2013; Miller, 2002).

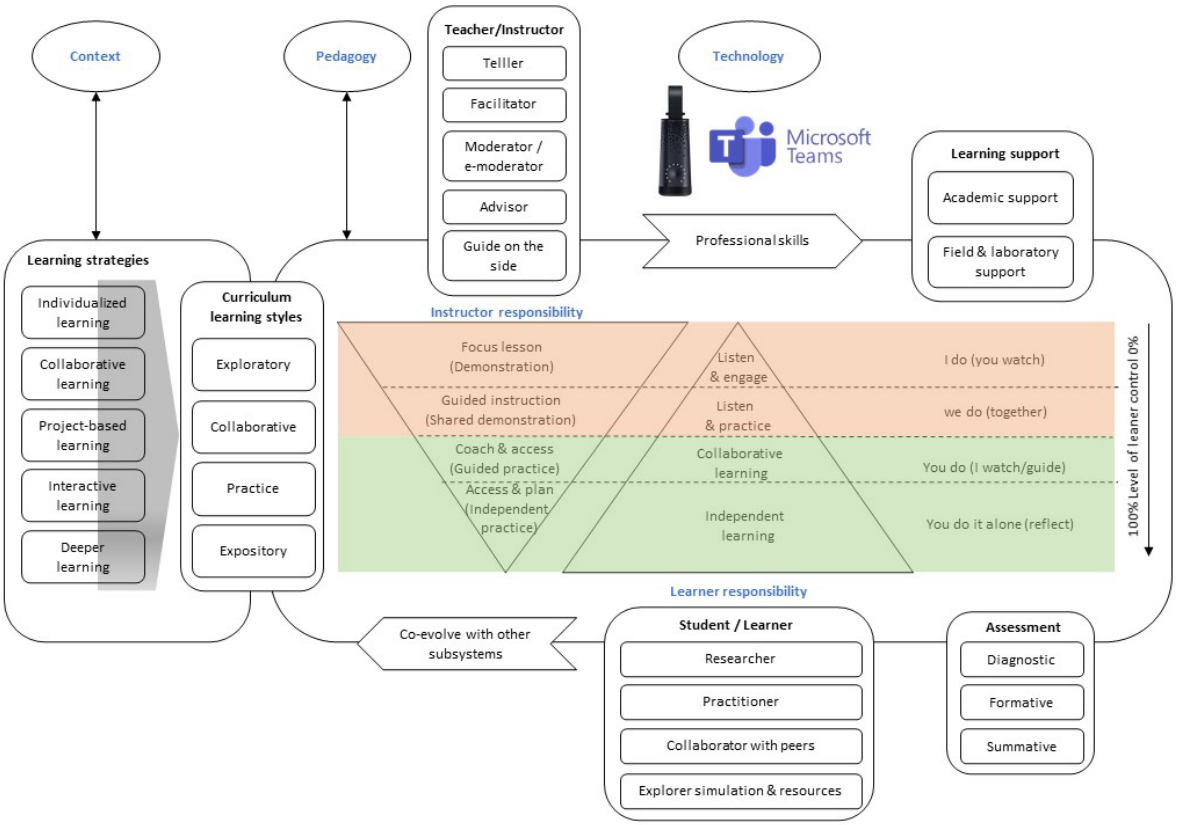


Figure 6: Low-cost sensors used in blended learning based on the technology, pedagogy and content knowledge (TPACK) model and the gradual release of responsibility (GRR) model (adopted from (Botha and Herselman, 2015; Eutsler, 2022; Fisher and Frey, 2013; Koehler and Mishra, 2005; Megahed and Hassan, 2022; Saudelli and Ciampa, 2016))

This research applied the TPACK model, integrating the new technology (portable low-cost sensors) into the pedagogy and content knowledge. Students used the sensors, without access to laboratory during the pandemic, to measure different kinds of air pollutants and practice their skills and explore new local knowledge on air quality. The survey and interviews confirmed the positive feedback on learning using low-cost sensors from students (Figures 3 and 4).

To train students to become independent learners, the GRR model was applied in this research. Firstly, the instructor demonstrated how to use the sensors to measure air quality, while students mainly listened and watched. Secondly, the instructor and students used the sensors together, creating an environment where students can participate along with listening and watching. Thirdly, students used sensors with the instructor's guidance and watching. Lastly, students applied sensors alone, providing an independent learning and reflection process. The survey data showed more than 90% of the students thought that their learning using low-cost sensors "develops abilities as an independent leaner" (Figure 3).

Field and laboratory learning makes an enormous contribution to the development of students' professional skills and indispensable life skills, such as communication and teamwork skills. Irrespective of any measures adopted, universities need to maintain high academic standards and provide good learning experience required for delivering learning outcomes. For situation without access to low-cost sensors, it is still important to produce virtual field and laboratory learning experiences that incorporate photos/results from the field and equipment in the laboratory (Endean and Braithwaite, 2012). Unfortunately, some graduates may suffer from little laboratory practice and skills in the COVID-19 pandemic, probably a long-term, even life-long, disadvantage (Daniel, 2020). Some training, for example, vocational education, is needed for this cohort of students.

This research offers several implications for pedagogic practices and research. Firstly, the successful application of low-cost sensors in the author's teaching sheds light on the appealing potential of expanding the application of low-cost sensors in Environmental Science/Engineering and other teaching programmes, such as Biology, Geography, and Ecology. In the post-COVID-19 era, students will gradually return to laboratories, with access to large and advanced equipment. However, low-cost sensors can still significantly supplement traditional laboratory education. In situations of equipment failure or unavailability of expensive equipment due to various reasons - for example, financial constraints - low-cost sensors can still play an essential role in increasing students' practical skills after the pandemic. Undisputedly, low-cost sensors have some limitations, compared to the advanced and complicated equipment. All low-cost sensors, including the Flow 2 used in the current study, are subject to possible data bias (Giordano et al., 2021). Therefore, regular calibration of these sensors, along with using other equipment, is needed to improve data accuracy. Secondly, in addition to purchasing the sensors from the market, students can also assemble such sensors using different kinds of modules and boards, with supervision from teachers, in a process called the Educational Hardware Hackathon (Richard et al., 2015). Thirdly, it is still unknown when COVID-19 will completely end in the world and what other crisis pedagogy we may encounter in the future, so universities need to learn from the ongoing COVID-19 pandemic and better prepare for the next one. The current study focused on the application of low-cost sensors in the environmental science/engineering programme education at one university. Future studies can further explore the application of low-cost sensors in different subjects at multiple universities in various countries. Studies with a larger scope can enhance our understanding of the contribution of low-cost sensors to students' learning.

5. Conclusion

The Covid-19 pandemic has forced universities to employ e-learning and blended learning, with the consequence of accelerating their development in the last two years. Notably, students' practical skills have been little developed by the online learning alone. In this study, the application of low-cost sensors, without access to laboratories and large equipment, has brought some opportunities to develop students' hands-on experience and improve their professional skills and employability. Learning in small groups also creates a learning community, which is crucial in developing students' teamwork and communication skills and improving mental health during the pandemic. Blending learning will likely become the new normal in the post COVID-19 era and reshape the future of education. These findings have important implications for developing students' practical skills, not only for Environmental Science/Engineering students, but also for other programme students (e.g., Biology, Ecology, Medicine and Geography) in blended learning.

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References

Botha, A., and Herselman, M. (2015). "A Teacher Tablet Toolkit to meet the challenges posed by 21st century rural teaching and learning environments." *South African Journal of Education*, Vol 35, No. 4, pp 1-19.

Braun, V., and Clarke, V. (2012). *Thematic analysis*, in Cooper, H., Camic, P., M, Long, D., L, Panter, A., T, Rindskopf, D., and Sher, K., J., (eds.) *APA Handbook of Research Methods in Psychology, Vol 2: Research Designs: Quantitative, Qualitative, Neuropsychological, and Biological*, American Psychological Association, Washington, DC, pp. 57-71.

Chan, K. S., Schillereff, D. N., Baas, A. C. W., Chadwick, M. A., Main, B., Mulligan, M., O'Shea, F. T., Pearce, R., Smith, T. E. L., van Soesbergen, A., Tebbs, E., and Thompson, J. (2021). "Low-cost electronic sensors for environmental research: Pitfalls and opportunities." *Progress in Physical Geography*, Vol 45, No. 3, pp 305-338.

Chen, W. Z., and You, M. L. (2010). "Student response to an Internet-mediated industrial design studio course." *International Journal of Technology and Design Education*, Vol 20, No. 2, pp 151-174.

Crowther, P. (2013). "Understanding the signature pedagogy of the design studio and the opportunities for its technological enhancement." *Journal of Learning Design*, Vol 6, No. 3, pp 18-28.

Daniel, S. J. (2020). "Education and the COVID-19 pandemic." *Prospects*, Vol 49, No. 1, pp 91-96.

Davies, C. (2008). *Laboratory and Practical Work in the Engineering Curriculum. Learning and Teaching in Laboratories*, The Higher Educational Academy Engineering, Heslington, UK.

Dhawan, S. (2020). "Online learning: A panacea in the time of COVID-19 crisis." *Journal of Educational Technology Systems*, Vol 49, No. 1, pp 5-22.

Endean, M., and Braithwaite, N. (2012). "Online Practical Work for Science and Engineering Students - A Collaborative Scoping Activity between the UK Open University and East China University of Science and Technology", [online], http://www.open.ac.uk/about/teaching-and-learning/esteem/sites/www.open.ac.uk.about.teaching-and-learning.esteem/files/files/ecms/web-content/2012-08-Mark-Endean-final-report.pdf.

Eutsler, L. (2022). "TPACK's pedagogy and the gradual release of responsibility model coalesce: integrating technology into literacy teacher preparation." *Journal of Research on Technology in Education*, Vol 54, No. 3, pp 327-344.

Fisher, D., and Frey, N. (2013). *Better learning through structured teaching: A framework for the gradual release of responsibility*, Association for Supervision & Curriculum Development, Alexandria, VA.

Gamage, K. A. A., Wijesuriya, D. I., Ekanayake, S. Y., Rennie, A. E. W., Lambert, C. G., and Gunawardhana, N. (2020). "Online delivery of teaching and laboratory practices: continuity of university programmes during COVID-19 pandemic." *Education Sciences*, Vol 10, No. 10, pp 291.

Giordano, M. R., Malings, C., Pandis, S. N., Presto, A. A., McNeill, V. F., Westervelt, D. M., Beekmann, M., and Subramanian, R. (2021). "From low-cost sensors to high-quality data: A summary of challenges and best practices for effectively calibrating low-cost particulate matter mass sensors." *Journal of Aerosol Science*, Vol 158, No., pp 1-23.

Horsburgh, J. S., Caraballo, J., Ramirez, M., Aufdenkampe, A. K., Arscott, D. B., and Damiano, S. G. (2019). "Low-Cost, Open-Source, and Low-Power: But What to Do With the Data?" *Frontiers in Earth Science*, Vol 7, No., pp 1-14.

Jonassen, D. H., Howland, J., Moore, J., and Marra, R., M. (2003). *Learning to solve problems with technology: A constructivist perspective*, Merrill Prentice Hall, Upper Saddle River, NJ.

Kapilan, N., Vidhya, P., and Gao, X.-Z. (2021). "Virtual laboratory: A boon to the mechanical engineering education during Covid-19 pandemic." *Higher Education for the Future*, Vol 8, No. 1, pp 31-46.

Khanal, R. (2021). "Crisis Pedagogy: Student Perceptions of Pedagogical Transition amidst the COVID-19." *Pedagogical Research*, Vol 6, No. 2, pp em0094.

Koehler, M. J., and Mishra, P. (2005). "Teachers learning technology by design." *Journal of computing in teacher education*, Vol 21, No. 3, pp 94-102.

Krishnamurthy, S. (2020). "The future of business education: A commentary in the shadow of the Covid-19 pandemic." *Journal of Business Research*, Vol 117, No., pp 1-5.

Lewis, D. I. (2014). *The pedagogical benefits and pitfalls of virtual tools for teaching and learning laboratory practices in the biological sciences*, The Higher Education Academy, Heslington, UK.

Lindstrom, T., and Middlecamp, C. (2017). "Campus as a Living Laboratory for Sustainability: The Chemistry Connection." *Journal of Chemical Education*, Vol 94, No. 8, pp 1036-1042.

Loeb, S., Dynarski, S., McFarland, D., Morris, P., Reardon, S., and Reber, S. (2017). *Descriptive Analysis in Education: A Guide for Researchers (NCEE 2017-4023)*, U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Washington, DC.

Megahed, N., and Hassan, A. (2022). "A blended learning strategy: reimagining the post-Covid-19 architectural education." *Archnet-Ijar International Journal of Architectural Research*, Vol 16, No. 1, pp 184-202.

Megahed, N. A. (2014). "Augmented Reality based-learning assistant for architectural education." *International Journal on Advances in Education Research*, Vol 1, No. 1, pp 35-50.

Michaelsen, L., K., Parmelee, D., X , Hyderi, A., and Sweet, M. (2011). *Team- Based Learning: overview and best evidence*, in Brown, T. and Williams, B., (eds.) *Evidence-Based Education in the Health Professions*, CRC Press, London, UK, pp. 313-329.

Miller, D. (2002). *Reading with meaning: Teaching comprehension in the primary grades*, Stenhouse Publishers, Portsmouth, NH.

Mulenga, E. M., and Marbán, J. M. (2020). "Prospective teachers' online learning mathematics activities in the age of COVID-19: A cluster analysis approach." *Eurasia Journal of Mathematics, Science and Technology Education*, Vol 16, No. 9, pp 1305-8215.

Murphy, M. P. A. (2020). "COVID-19 and emergency eLearning: Consequences of the securitization of higher education for post-pandemic pedagogy." *Contemporary Security Policy*, Vol 41, No. 3, pp 492-505.

Nel, C., and Marais, E. (2020). "Preservice Teachers Use of WhatsApp to Explain Subject Content to School Children during the COVID-19 Pandemic." *International Journal of Work-Integrated Learning*, Vol 21, No. 5, pp 629-641.

QAA. (2020). "COVID-19: Thematic Guidance-Practice and Lab-Based Assessment", [online], https://www.qaa.ac.uk/docs/qaa/guidance/covid-19-thematic-guidance-work-based-learning.pdf?sfvrsn=e3cecd81_8.

Richard, G. T., Kafai, Y. B., Adleberg, B., and Telhan, O. "StitchFest: Diversifying a College Hackathon to broaden participation and perceptions in computing." *Presented at SIGCSE '15: The 46th ACM Technical Symposium on Computer Science Education*, Kansas City, MO, USA,.

Rose, S. (2020). "Medical Student Education in the Time of COVID-19." *Journal of the American Medical Association*, Vol 323, No. 21, pp 2131-2132.

Saghafi, M. R., and Crowther, P. (2021). "Integrating technology subjects with design studio teaching: comparing curriculum of architecture education in Australia and Iran." *Archnet-Ijar International Journal of Architectural Research*, Vol 15, No. 3, pp 652-667.

Saudelli, M. G., and Ciampa, K. (2016). "Exploring the role of TPACK and teacher self-efficacy: an ethnographic case study of three iPad language arts classes." *Technology Pedagogy and Education*, Vol 25, No. 2, pp 227-247.

Teixeira, D., Maron, M., and van Rensburg, B. J. (2019). "Bioacoustic monitoring of animal vocal behavior for conservation." *Conservation Science and Practice*, Vol 1, No. 8, pp e72.

Teräs, M., Suoranta, J., Teräs, H., and Curcher, M. (2020). "Post-Covid-19 education and education technology 'solutionism': A seller's market." *Postdigital Science and Education*, Vol 2, No. 3, pp 863-878.

Yang, H. (2021a). *Application of project based learning in an environmental engineering programme*, in Guerra, A., Chen, J., Winther, M., Kolmos, A., and Nielsen, S. R., (eds.) *Educate for the future: PBL, Sustainability and Digitalisation 2021*, Aalborg University, Aalborg, Denmark, pp. 195-205.

Yang, H. (2021b). *Environmental Engineering undergraduate dissertation work during the Covid-19 pandemic*, in Heiß, H.-U., Järvinen, H.-M., Mayer, A., and Schulz, A., (eds.) *European Society for Engineering Education (SEFI) 49th Annual Conference: Blended Learning in Engineering Education: Challenging, Enlightening - and Lasting?*, Technische Universität Berlin, Berlin, pp. 1337-1345.

PhD Research Papers

Exploring Augmented Reality Affordances for Media Literacy in the EFL Context

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Abstract: The ever-evolving information and communication technologies (ICTs) have affected the learners' preferences for on-demand and on-the-spot access to information that challenge the traditional classroom practices and call for a reconstruction of curricula. New educational approaches are to be encompassed so as to align with the tech-savvy Generation Z needs and the contemporary digitized world that demands competences and skills for successful and well-informed personal and professional choices. Nevertheless, consumption and creation of new knowledge in the plethora of the new crowdsourced information ecosystem have to be critically accessed, analyzed, evaluated, and leveraged so as to lead to creativity and innovation. This paper is a report of the design of an educational intervention with the intent to enhance students' media literacy skills in the English as a Foreign Language (EFL) secondary education context leveraging immersive technologies. In the first part there is a review of related work leveraging AR affordances in the EFL context. The second part explores the instructional design and pedagogical framework that AR assets can enrich a course material on media literacy for inclusive education practices taking into consideration students' preferences on their learning process.

Keywords: augmented reality, media literacy, EFL, secondary education, instructional design

1. Introduction

Technology has revolutionized the way we live, work, learn about and experience the world. The new generation of learners, *Generation Z*, and the one that succeeds it, *Generation Alpha*, were born in the world of Internet and ubiquity of handheld devices. As such, they have access to new knowledge and information that derives beyond the traditional brick-and-mortar education, leveraging the affordances of on-the-spot and on-demand answers to questions that previous generations did not enjoy. The teacher is no longer the authority of knowledge transfer nor is the school textbook, leading learners to demotivation and disengagement. These distinct characteristics can be interpreted as a personalized learning experience, based on individual needs and preferences, to either acquire a general perception of what the world we live in is like, or pursue an answer to a specific question with the intent to fill gaps of knowledge. To add to this, the ever-evolving new technologies combined with the recent COVID-19 restrictions and unprecedented and abrupt need to educational shift to virtual environments has transformed the educational landscape and enhanced the appreciation of their affordances by the broader learning community. Though there were considerable educational interventions with the use of technologies long before the COVID-19 era, the recognition of their value to seamlessly continue the learning process opened new doors and prospects, accelerated our digital skills development, and thus led to our awakening to the need of creating new paths to learning and transforming the educational landscape (Bozkurt et al, 2020).

The integration of emerging media into lesson content has brought about new opportunities for learners' engagement, motivation, and satisfaction as it allows for enrichment of the way they experience the learning process making connections to the real world. The ubiquity and pervasiveness of mobile devices, this new reality, can positively influence the learning ecosystem, leveraging what new technologies have to offer, making the invisible visible, and the inaccessible accessible at a low cost. In light of this, when it comes to language learning, especially in an interdisciplinary approach with Content and Language Integrated Learning (CLIL), the multimodality of Augmented Reality (AR) and Virtual Reality (VR) can be seen as a successor of past Computer-Assisted Language Learning (CALL) and Mobile Assisted Language Learning (MALL) that can help students personalize their learning experience gaining significant insights on comprehension and analysis of abstract notions and poor contextualization of learning objects. This multimodality aspect aligns with the Universal Design for Learning (UDL) principles (CAST, 2011), as these principles, namely, multiple means for representation, engagement, and action and expression find fruitful ground to be implemented in the instructional design of AR/VR activities, providing learners with an inclusive, rich learning experience. Additional benefits focus on information overload management; collaboration; communication and sharing; creation; and problem-solving.

The paper consists of two main parts. In the first part there is an exploration of Augmented Reality practices in the EFL secondary education context, and insights gained based on what literature suggests. In the second part there is a report of steps taken to design an extensive 4-month course for a project for EFL learners on a transnational level, leveraging the ARTutor App affordances that do not require any sophisticated ICT skills on behalf of the instructional designer. A pre-course survey informed the analysis stage of learners' needs, competences, and learning preferences. The design of the course was based on a participatory culture that learners had their own voice on selecting the type of augmentations to be added to and enrich the materials developed and assessment method.

2. Review of related work

Latest trends in technologies, such as Augmented Reality (AR) technologies have already been successfully leveraged by industry, science, commerce, tourism, engineering, training, to name a few fields, as digital content is superimposed over real objects enriching the physical world with additional information in real time (Azuma, 1997). They have also started to gain field in the educational context as they may enhance the learning experience and accommodate learners' diverse needs. As Lytridis and Tsinakos (2018, p. 1) posit, "Augmented Reality is a technology which enriches human senses and mixes real and virtual environments, leading to a new, more informative and stimulating environment". As such, AR applications have a positive effect on educational outcomes such as learner achievement, attitude, motivation, attention, and retention in the learning process (Mustafa & Tuncel, 2019). Literature suggests that enhancing learning achievement and motivation are the most obvious findings from AR and VR research (Bacca et al., 2014; Akçayır & Akçayır, 2017; Khoshnevisan & Le, 2018). Papanastasiou et al. (2019) contend that it is the learner-centered experience and flexibility in discovering and constructing knowledge at their own pace that immersive technology property allows for added value to the learning process. Enriching the content with materials in different modalities such as auditory stimuli, written text, infographics, images, videos, 3D models, etc, on the premise that they are based on a well-informed instructional design, as Akçayır and Akçayır (2017) note, diminishes the cognitive load, stress and anxiety levels (Liu, 2009). Accordingly, in the special education context, assistive technologies can also play a crucial role in facilitating the learning process of learners that may be either physically or cognitively challenged with the integration of multimedia elements (Lee, 2007; Dunleavy et al., 2009; Forsyth, 2011; del Cerro Velázquez & Morales Méndez, 2018; Quintero et al., 2019).

Blyth (2018) posits that developers are currently making VR and AR more accessible, more user-friendly, and with cheaper versions of existing products. These features expand possibilities of CLIL approach to be incorporated in the foreign language learning context, by providing realistic and authentic situations through emotional auditory and visual stimuli. As such, students have a better understanding of languages and cultures in a 'virtually authentic' context from a sociocultural perspective. Zhang, Wang, and Wu (2020) stress the sociocultural aspect of language acquisition valuable insights into the development of human language from a psychological perspective. They reference Lantolf et al.'s (2015, p. 207) recent definition of sociocultural theory (SCT) as a theory of mind that acknowledges that "human mental functioning is fundamentally a mediated process that is organized by cultural artifacts, activities, and concepts", denoting key constructs in SCT, including mediation, internalization, and the Zone of Proximal Development (ZPD) as essential components of meaningful and long-lasting learning experiences.

In the context of adolescent foreign language learners, Kucuk, Yilmaz, and Goktas (2014) investigate learners' achievement, attitude, and cognitive load levels when learning English as a foreign language with the aid of AR. A book was created with the aid of marker-based technology and Metaio Creator software, and materials were additionally supported by English pronunciation. The implementation phase involved four sessions, in computer laboratories and under the guidance of teachers to ensure digital skills capability. Findings reveal that cognitive load levels and anxiety of students are low when engaged in the process of self-directed learning in an AR environment. Based on Mayer's (2002) multimedia theory as a base to form AR environments, the authors note that the importance of well-designed interactive multimedia materials for learner's active participation in alignment with the learning objectives to facilitate students' experiential information processing capacity from various perspectives and decrease of cognitive load. In more recent studies, Bursali and Yilmaz (2019) conducted a survey with a mixed method, recruiting 5th grade students that were split in experimental and focus groups in order to discuss the effect of AR applications on secondary school students' reading comprehension and learning permanency. Findings reveal that the experimental group students showed a higher level of reading comprehension and learning permanency. The students also reported that

they experienced satisfaction from their participation in AR-based reading activities, and low anxiety levels. Chang, Chen, and Liao (2020) conducted a study based on Keller's (1987) ARCS learning motivation theory, namely, attention, relevance, confidence, and satisfaction to support situational classroom learning and improve performance and foreign language learning effectiveness with the use of augmented reality. The English learning scenario was supported by HD Reveal Aurasma platform and app with the intent to enhance language input and output with airport situation-related conversation themes. The experimental results, as in previous studies, revealed that the real-life AR scenarios enhanced student confidence in learning English, and applying AR teaching materials in situational context classes can provide near real-life scenarios and improve the learning satisfaction of students. Nevertheless, so far studies focus on a short-term implementation period in educational settings testing homogeneous socio-cultural student attitudes, in instructor-based selection of materials. Additionally, AR-based collaborative learning and social interaction in the EFL context in the digitally connected world has not been examined on a broad scale. According to UNESCO's (2017, p. 4) 2030 agenda for sustainable development, inclusive education systems should focus on creating more inclusive and equitable societies, ensuring that 'no one is left behind', which coupled with the need of the contemporary learner for interaction in a digitally connected multicultural context, call for further research.

3. The educational intervention

Based on what literature suggests and to fill gaps, there will be an effort to design an educational intervention that will further explore AR affordances within a pedagogical framework addressing socio-culturally diverse student populations. The present paper presents steps taken to address the needs of students of three different educational settings and countries that will interact for four months on a project on media literacy skills enhancement, with materials developed in English and on the subject matter purposefully enhanced with multimedia elements added on the ARTutor web authoring platform. ARTutor consists of a web-based application that acts as an AR authoring tool, and an accompanying mobile application that is used to access and interact with the educational AR content (Lytridis, Tsinakos & Kazanidis, 2018). The platform was chosen based on (a) free access; (b) non-IT expert requirements for an educator to leverage its functionalities; (c) students' response to the pre-course survey to state preferences on the media choices that they would like to explore in their learning process; (d) its functionalities that can accommodate a variety of augmentations, ranging from images, 3D models, audio, video, and embedded links, and (e) its compatability with a wide range of mobile devices. Additionally, the design of the study aims to involve students in AR-based media production.

3.1 Description of the educational intervention

Based on participants' responses on media preferences, the material was produced in the ARTutor web authoring tool in order to enrich students' learning experiences in digital and media literacy skills enhancement and maximize opportunities for personalized, inclusive learning combining augmented reality (AR) affordances and language learning in a CLIL educational context. For the *Media Literacy in Practice* course, text and static presentation of digital and classroom printed material in the form of a booklet was created and enriched with 11 augmentations that include AR assets such as images-infographics, auditory augmentations, videos, and links that facilitate the implementation of the Universal Design for Learning (UDL) Principles (CAST, 2011) in the English as a Foreign Language (EFL) learning setting. More specifically, the assets added bear the following educational affordances:

- The visualization of abstract concepts allowing for dual coding connotations – *infographics*
- Auditory explanations with examples and further information on the written text to facilitate students with reading difficulties (SEN) and enhance L2 listening (and pronunciation) skills – *mp3*
- Multisensory explanations that enhance long term memory retention of information – *video*
- Gamification as a means of edutainment and alternative formative and summative assessment – *embedded links*
- A collaborative digital wall for social-constructivism approach and participatory learning to facilitate group work, evaluation, and reflection on the learning process – *embedded link*.

The material produced can be used either within the classroom setting or at students' own time, space, and pace to provide opportunities for unlimited access to supportive, personalized learning, limiting digital distraction from the learning object of the printed material. It was designed to enrich a course on media literacy based on students' prior knowledge, cognitive level, digital competences, and learning preferences and

provide opportunities for AR-based collaborative work. The multimodality employed complies with the Universal Design for Learning Principles. Theory and examples of the assets deployed in the intervention are depicted in Figure 1.

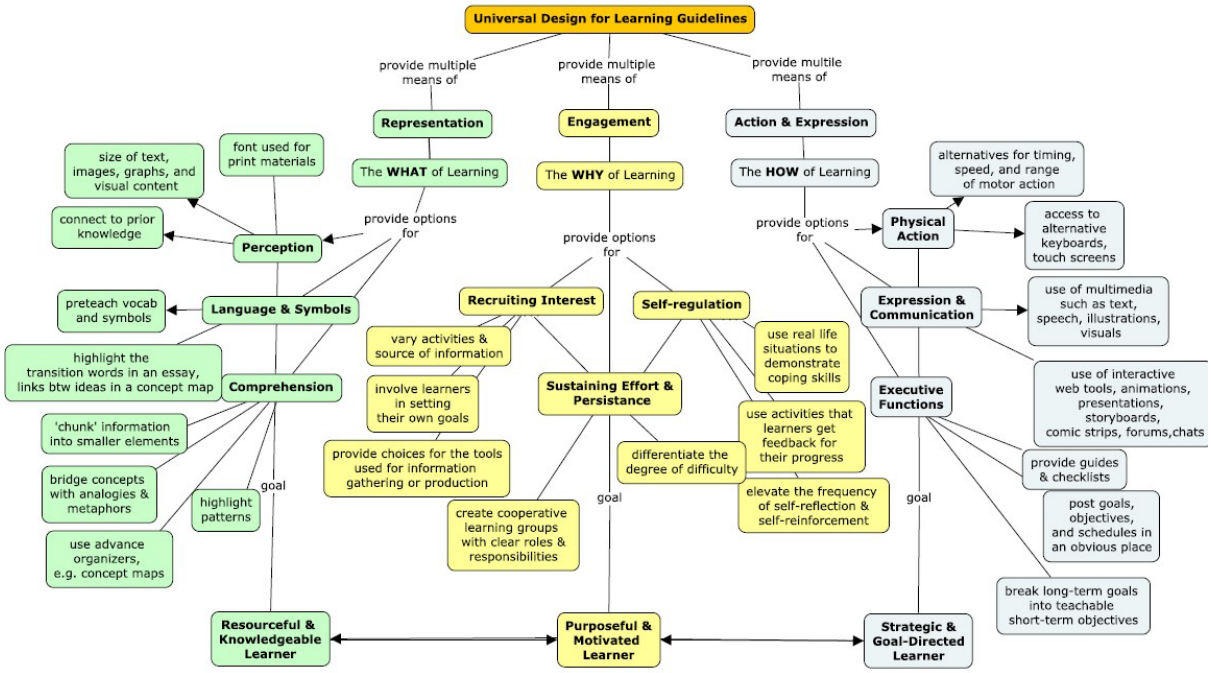

Figure 1: Theory and examples of the employment of UDL principles in the study (Lazou, 2019)

3.2 The educational purpose and goals of the intervention

The main aim of this intervention is to enrich learners' experiences in an educational setting with AR assets that seamlessly blend the physical environment with the digital content, contextualizing the EFL materials on the thematic area of media literacy. The AR-booklet assets address the UDL framework for (a) perception and comprehension of concepts, as a multiple means of representation; (b) recruiting of interest, self-regulation, and sustainable interest for engagement; and (c) physical action, expression and communication, and executive functions for action and expression, providing ample opportunities for mastery of the content and the language through inclusive educational practices (Figure 1), reaching high levels of Bloom's taxonomy. More specifically, by the end of the course the learners, with the aid of the AR assets, will be able to:

- define and list basic media literacy concepts
- identify and categorize different types of misleading information
- use the media literacy strategies to interpret news articles
- analyze, deconstruct and reconstruct information
- apply theory to check distorted truth, bias, and opinion versus fact
- evaluate and reflect on how successful they are in fact-checking
- create quality content

3.3 The implementation processes

The ADDIE model of instructional design (Kurt, 2018), that is, analysis, design, development, implementation, and evaluation was employed in the specific educational intervention. As such, in order to achieve digital and media literacy skills enhancement for the educational setting intended to be used, the following steps were taken to produce the AR enriched material for the educational intervention:

3.3.1 Analysis

i. Analyze students' prior knowledge in L2 and their digital and media literacy background.

ii. Analyze and determine learning objectives.
iii. Analyze ARTutor web platform authoring affordances.
iv. Analyze mobile learning affordances.
v. Analyze the learning environment that is suitable to be implemented.

3.3.2 Design

i. Design learning materials and activities in alignment with the intended outcomes.
ii. Design multimedia elements, such as text, graphic, audio, video, and games, addressing students' responses on learning preferences.
iii. Design the collection of triggered images for marker-based AR content.

3.3.3 Development

i. Develop the booklet (learning contents), indicate the triggered images with clear instructions for easy-to-follow steps for students ("Scan the image for further info…"), and turn it into a pdf file.
ii. Develop the learning contents consisting of multimedia elements that can be uploaded in the web authoring tool of ARTutor platform.
iii. Save all materials developed in a folder for easy access when moving to the implementation phase of the booklet AR enrichment on the web authoring tool.

3.3.4 Implementation

i. Upload the pdf file of the booklet developed (learning content) on the ARTutor platform.
ii. Align the selected images per page to be triggered with each of the multimedia elements.
iii. Save the new enriched booklet and download it with its corresponding QR code.

3.3.5 Evaluation

i. Evaluate the usability of the application by testing the augmentations on the mobile app on both digital and printed form of the booklet, as depicted in Figure 2.
ii. Collect feedback regarding user acceptance of the application from volunteer users.

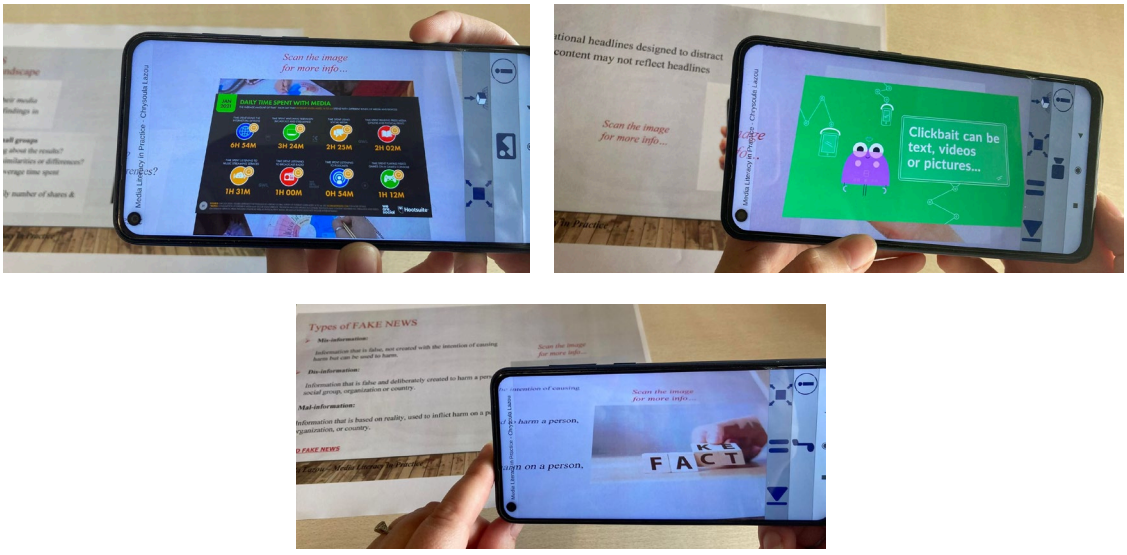

Figure 2: Examples of visual, multimedia, and auditory augmentations added to the printed material. The first figure (left) displays feedback on an activity (infographic with statistics), the second (right) a video, and the third (down) an auditory explanation on theory

3.4 Prototype implementation details and tools used

The study explores how participants can benefit from the multimodality that immersive technologies can provide learners for inclusive educational practices. To this end, there was a strategic design of activities that are in alignment with the intended learning outcomes. The augmentations added were purposefully added based on participants' responses to their learning preferences, including a variety of multisensory media and

assets that the functionalities of the platform employed support. Table 1 consists an analytical description of the activities in the booklet with the indication of the page, the corresponding learning goals, the assets that were added to enrich and add value to the material based on UDL, and the additional external tools used.

Table 1: Prototype implementation activities, learning goals, assets, tools used, and added value

Activity	Learning goal/Objective	Augmentation/Asset	Tool used	Added value based on UDL
1. My Media Landscape (p. 5)	Familiarize with types of mass media and explore media consumption trends	Infographic	Web source	Visualization of results based on statistical information/curated feedback – *engagement, self-regulation*
2. Media Literacy Core Concepts (p. 6)	Enumerate and illustrate on MIL Core Concepts	Auditory augmentation	Voice recorder	Further oral explanations of abstract concepts/ personalized learning inclusive for SEN students /listening skills enhancement – *perception, communication and expression*
3. MIL Core Concepts game (p. 7)	Check understanding	Educational game	wordwall.net	Edutainment/ alternative formative assessment approach – *recruiting interest, sustaining effort and persistence*
4. Evaluating news articles (p. 8)	Identify key strategies for MIL and develop fact checking skills	Infographic	Web source (Image from MCLA Library)	Visualization of strategies with pointers to enhance memory retention – *perception, language and symbols, provide guides and checklists*
5. Types of fake news (p. 9)	a. Categorize the types of fake news according to intentions b. Enhance vocab and L2 prefix nuances	Auditory augmentation	Voice recorder	Additional information and examples of content and language nuances (CLIL) – *comprehension, bridge concepts with analogies*
6. Clickbait explained (p. 11)	Analyze content, deconstruct and reconstruct meaning	Video	YouTube	Multisensory material to explain abstract notions with examples – *long term memory enhancement*
7. Pseudoscience vs Science (p. 12)	a. Differentiate content that is not curated but misinterpretation of scientific studies. b. analyze, compare and contrast concepts in L2	Infographic	Web source	Visualization of text that clarifies misunderstanding/L2 vocabulary enhancement – *language and symbols, executive function*
8. The Millionaire Game /Play and Learn (p. 13)	Check understanding	Educational game	Learningapps.org	Individualized formative assessment to reach mastery of content – *recruiting interest, sustaining effort and persistence*
9. The Wheel of Emotions (p. 14)	a. Analyze the power of format in the media b. Illustrate the nuances of synonyms c. Apply critical thinking skills to check emotions	Image	Plutchik's Wheel of Emotions image	Visualization and illustration of vocab on emotions nuances - colour intensity related to visual impact on emotions – *perception, language and symbols, comprehension*

Activity	Learning goal/Objective	Augmentation/Asset	Tool used	Added value based on UDL
10. MIL interactive Game (p. 15)	a. Apply new knowledge to real life context b. Evaluate L2 reading comprehension, critical thinking skills and media literacy competences	Interactive game	Quizizz.com	Reflective summative assessment – *recruiting interest, sustaining effort and persistence, self-reflection*
11. "Collaborative Digital Wall" - Consumption and creation of information based on MIL key strategies through collaborative learning (p. 2)	a. Develop digital, social, soft, and critical thinking skills b. Evaluate new knowledge c. Create new content d. Reflect on the learning process	Interactive digital wall for collaborative /Participatory learning experience	Padlet.com	Social constructivism learning in online environments. Interactive digital wall for collaborative learning/collection of artifacts/ reflection (ePortfolio) – *self-reflection, communication, action and expression*

4. The potential benefits and considerations

4.1 The potential benefits

Lytridis and Tsinakos (2018, p. 2) reference a systematic review of 17 studies between 2012 and 2017 conducted by Fotaris et al. (2017), according to which it is supported that "AR in education can potentially influence the students' attendance, knowledge transfer, skill acquisition, hands-on digital experience in education in a variety of domains". In a more recent survey, Radu et al. (2022) investigate the impact of AR technologies on cognitive, motivational, and social processes, noting that AR encouraged more balanced group dynamics reducing the dominance of group leaders in collaborative educational settings. In CLIL approach, content and language are of equal importance and serve as equal goals of instruction (Dearden, 2015) in a social-constructivism learning environment. As such, the AR interventions are designed to facilitate mastery of content and development of language receptive and productive skills based on inclusive educational practices that align with the UDL principles, as depicted in Table 1. More specifically, the educational intervention was designed to investigate the degree that students will have the opportunity to

- have unlimited access to learning objects with all assets digitally available, and how this will facilitate students that may lack organizational skills;
- explore innovative, personalized learning instances without being distracted from the textbook;
- experience new possibilities for student-content, student-student interaction both inside and outside the classroom enhancing engagement and motivation;
- connect reading with listening skills (auditory augmentations with teacher's explanations);
- practice the pronunciation of the new vocabulary through auditory augmentations on the textbook;
- enhance vocabulary in L2 and make connections of abstract concepts with everyday life examples;
- receive feedback on their activities through visualized content;
- connect lists of written texts with visuals, infographics, and pointers;
- work collaboratively and constructively on a shared digital authoring environment embedded in the AR enriched booklet;
- apply critical thinking skills, reflect, and create new content;
- develop digital writing skills in L2;
- self-assess and check progress and mastery of content through trial and error in a playful, engaging way (gamification/edutainment);

- create a group and whole class ePortfolio for the learning journey.

4.2 Considerations

The present educational intervention was designed with the intent to enrich students' learning experiences in an interdisciplinary approach through CLIL method in order to enhance their digital and media literacy skills in a diverse, transnational educational context. As aforementioned, literature suggests that Mobile Augmented Reality (MAR) can provide a very promising, immersive learning experience. Nevertheless, it is essential that certain limitations be taken into consideration. More specifically,

- The students should be introduced to the new technology before the sessions to avoid stress and frustration.
- An introductory session should be devoted to guide the students on how to download the app, check if their mobile devices are compatible with it, and then demonstrate and elaborate on how to use it.
- Students should understand the added value in their learning experience in order to make best use of each asset.
- If used in class, teachers should ensure the network quality of service.
- The augmentations have been designed to serve an educational purpose based on an instructional design approach. As such, given the novelty of the technology, teachers need to take careful steps during the implementation process to ensure a rich learning experience.
- To ensure inclusive educational opportunities for all students, the teacher should provide the enriched materials in both a digital and printed version.
- Privacy and security concerns should be addressed to ensure smooth content delivery.

Part of the considerations were addressed by creating manuals and tutorials for the educators that will implement the educational intervention.

5. Conclusions

Immersive technologies are still in their infancy in the mainstream educational setting and it is essential that meaningful, well-designed assets be added to the traditional printed textbooks and materials if they are to enhance students' experiences and facilitate their learning process. The *Media Literacy in Practice* AR enriched booklet constitutes an educational intervention that leverages the MAR affordances that the ARTutor app provides for an all-inclusive learning experience. The students' learning preferences were explored and guided the selection of AR platform and assets added in the design of the course materials. This effort aspires to meet diverse students' needs as dictated by the UDL principles and learning theories. On this premise, the present design of immersive MAR affordances consists of multisensory elements, such as pictures, infographics, text, audio, video, and embedded links for interactive gamification that can stimulate interest, attention, retention of content, and meaningful learning instances. The collaborative digital wall, based on the social-constructivism approach, was added to promote the development of the 4Cs skillset, that is communication, collaboration, critical thinking, and creativity in the EFL educational context (Pardede, 2020) and the opportunity for reflection and metacognition. The objectives are in alignment with UNESCO's 2030 Agenda (2017) for sustainable development, including SDG4 for quality education, ensuring that no-one is left behind in an ever evolving digitally connected world. Nevertheless, given the novelty of AR-based practices in education, and on the premise that their use can still be shapeable, there is a need to measure results and benefits on a broader scale, in diverse educational contexts, and eliminate potential limitations.

References

Akcayir, M. and Akcayir, G. (2017) Advantages and challenges associated with augmented reality crossMark for education: A systematic review of the literature. *Educational Research Review, 20*, pp. 1-11. https://pdfs.semanticscholar.org/d588/bfb109693795ad4d9e3d57fa3e13f649c903.pdf

Azuma, R. (1997) A Survey of Augmented Reality. *Presence: Teleoperators and Virtual Environments, 6*(4), 355- 385. doi: 10.1162/pres.1997.6.4.355

Bacca Acosta, J.L., Baldiris Navarro, S.M., Fabregat Gesa, R., and Graf, S. (2014) Augmented Reality Trends in Education: A Systematic Review of Research and Applications. *Educ. Technol. Soc. 17*, pp. 133–149.

Blyth, C. (2018). Immersive technologies and language learning. *Foreign Language Annals 51*: 225-232.

Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G., Lambert, S., Al-Freih, M., Pete, J., Olcott Jr, D. and Rodes, V., 2020. A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education*, *15*(1), pp.1-126.

Bursali, H., & Yilmaz, R. M. (2019) Effect of augmented reality applications on secondary school students' reading comprehension and learning permanency. *Computers in Human Behavior, 95*, pp. 126-135.

CAST (2011). *Universal Design for Learning Guidelines Version 2.0*, Wakefield, MA: Author.

Chang, Y. S., Chen, C. N., and Liao, C. L. (2020) Enhancing English-learning performance through a simulation classroom for EFL students using augmented reality—A junior high school case study. *Applied Sciences, 10*(21), 7854.

Dearden, J. (2015) English as a medium of instruction—A growing global phenomenon. The British Council. Retrieved from: https://www.britishcouncil.org/education/ihe/knowledge- centre/english-language-higher-education/report-english-medium-instruction

del Cerro Velázquez, F. and Morales Méndez, G. (2018) Augmented reality and mobile devices: A binomial methodological resource for inclusive education (SDG 4). An example in secondary education. *Sustainability, 10*(10), 3446.

Dunleavy, M., Dede, C., and Mitchell, R. (2009) Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. *Journal of Science Education and Technology, 18*(1), pp. 7–22.

Forsyth, E. (2011) Ar u feeling appy? augmented reality, apps and mobile access to local studies information. *Australasian Public Libraries and Information Services, 24*(3), 125.

Fotaris, P., Pellas, N., Kazanidis, I., and Smith, P. (2017) A systematic review of Augmented Reality game-based applications in primary education. In *Memorias del XI Congreso Europeo en Aprendizaje Basado en el Juego Graz* (pp. 181-191).

Keller, J. M. (1987) Development and use of the ARCS model of instructional design. *J. Instr. Dev. 10*, 2–10.

Khoshnevisan, B., & Le, N. (2018). Augmented Reality in Language Education: A Systematic Literature Review. *Adv. Glob. Educ. Res, 2*, 57-71.

Kucuk, S., Yilmaz, R. M., and Goktas, Y. (2014) Augmented Reality for Learning English: Achievement, Attitude and Cognitive Load Levels of Students. *Egitim Ve Bilim-Education and Science, 39*(176), 393-404.

Kurt, S. (2018) ADDIE Model: Instructional Design. *Educational Technology.* Retrieved from: https://educationaltechnology.net/the-addie-model-instructional-design/

Lantolf, J. P., Thorne, S. L., & Poehner, M. E. (2015) Sociocultural theory and second language development. *Theories in second language acquisition: An introduction, 1*, 207-226.

Lazou, C. (2019) A Concept Map of UDL Guidelines. Retrieved from: The Inclusive Educators' Toolbox. Athabasca University and Aspen View Public Schools.

Lee, Wah, L. (2007) Development of Multimedia Learning Resources for Children with Learning Disabilities in an Undergraduate Special Education Technology Course, *MEDC Vol.1*.,2007.

Liu, T. Y. (2009) A context-aware ubiquitous learning environment for language listening and speaking. *Journal of Computer Assisted Learning, 25*(6), 515-527.

Lytridis, C., and Tsinakos, A. (2018) Evaluation of the ARTutor Augmented Reality educational platform in tertiary education. Smart Learning Environments, 5(1), 6. http://doi.org/10.1186/s40561-018-0058-x

Lytridis, C., Tsinakos A., and Kazanidis I. (2018) ARTutor-An Augmented Reality Platform for Interactive Distance Learning. *Education Sciences. 8*(1):6.

Mayer, R. (2001) *Multimedia learning. Cambridge: Cambridge University Press.*

Mustafa, F., and Tuncel, M. (2019) Integrating augmented reality into problem-based learning: The effects on learning achievement and attitude in physics education. *Computers & Education*, 103-635. doi:10.1016/j.compedu.2019.103635.

Papanastasiou, G., Drigas, A., Skianis, C., Lytras, M. and Papanastasiou, E. (2019) Virtual and augmented reality effects on K-12, higher and tertiary education students' twenty-first century skills. *Virtual Reality, 23*(4), 425–436. doi:10.1007/s10055-018-0363-2.

Pardede, P. (2020) Integrating the 4Cs into EFL Integrated Skills Learning. *Journal of English Teaching, 6*(1), 71-85.

Quintero, J., Baldiris, S., Rubira, R., Cerón, J., and Velez, G. (2019) Augmented reality in educational inclusion. A systematic review on the last decade. *Frontiers in psychology, 10*, 1835.

Radu, I., Joy, T., Bott, I., Bowman, Y., and Schneider, B. (2022) A Survey of Educational Augmented Reality in Academia and Practice: Effects on Cognition, Motivation, Collaboration, Pedagogy and Applications. Immersive Learning Research Network. 978-1-7348995-2-8/22

UNESCO (2017) A guide for ensuring inclusion and equity in education. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000248254

Yusof, A.M., and Ab. Aziz, K. (2010) Creative Industries in Education: The Creativity of Teaching Method Using Animation. *International Conference of Education, Research and Innovation*, p. 4102-410.

Zhang, D., Wang, M., and Wu, J. G. (2020) Design and implementation of augmented reality for English language education. *In Augmented Reality in Education*, pp. 217-234. Springer, Cham.

A new e-Learning Resource to Support Music Education in Romanian Schools

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Abstract: The pandemic has demonstrated the need for e-learning tools to support Romanian music education. The lack of digital resources in the national language adapted to the Romanian music curriculum made it difficult for students to learn using foreign applications with a different music notation system from Romania's during the online teaching period. In response to this, we created a software tool that supports musical instruction in line with the outcomes expected by the country's school music curricula. This study investigated the effect of the new software on improving learning outcomes and student motivation. The participants were three experimental groups from eight schools. Group A (n = 60 pupils) were required to use the software for six weeks, at least 15 minutes per day, five days a week. This was carried out under teacher supervision in classrooms and under teacher guidance at home. Group B (n = 61 pupils) were asked to use the software once a week for six weeks in their music lessons. Group C (n=10 teachers) lead the application's testing process. Each child was allocated a unique code (to ensure each pupil's anonymity), which enabled the researcher to observe their activity. The average total use per child in Group A was 48 sessions, and for Group B, it was 12 sessions. The results for Group A showed pupils had notably enhanced their learning outcomes. Of the (n=60) pupils, 96% reported feeling 'highly motivated' by the software. The tool's facility for personalised, needs-focused exercises with immediate feedback was identified as particularly helpful. Group B, who used the software occasionally, made slower progress, but 93% reported that the addition of the software was preferable to traditional classroom music education conducted without such individual-focused technology. Out of (n=121) pupils, 94% reported the software was easy to learn and use. Each of the ten teachers who led the testing process reported increased accuracy of the elements practised with the software after six weeks of usage and decided to continue using it. More exercise resources are currently being developed for the software. Now also in English, it is easily translatable into other languages.

Keywords: ICT integration, music education, digital resources, music technology, music software

1. Introduction

The evolution of digital technology with its applicability in any field has brought significant improvements in education and research in many parts of the world (Klasnja-Milicevi, 2018). Multiple research projects in the education field have shown that the use of technologies in the teaching-learning-assessment process has raised performance to a higher level, increasing the students' levels of satisfaction and generating a more positive attitude in the classroom (Condie et al., 2007; Innes, 1997; Savage, 2007). One of the positive influences on the learning process observed from the use of music technologies is that students become more receptive to study by becoming active participants (Valdivia et al., 2021). Following a project involving the use of music technology in music classes, Louise Cooper (2017) reported that students became highly focused on technology-mediated projects, with even those students with difficulties being motivated and engaged in sustained work when they used the technology. It is well recognised that one of the advantages brought by technologies into education is the possibility of immediate feedback. Learners and teachers can then properly adjust the learning process and enhance learning outcomes (Tacoma et al., 2020; Wong et al., 2017).

Savage (2017) mentions the role of technologies in music as a support in listening to, understanding, performing, and composing music. Harding and Ward (2020) state that music technologies help teachers offer a cross-curricular approach to music education, which the Romanian music curricula have requested since 2017 (MNE, 2017. They state that technologies facilitate the embedding of aspects and knowledge from other disciplines, such as literacy, numeracy, mathematics, history, poetry, and IT, and so are also useful tools for teaching STEM subjects (Science, Technology, Engineering, and Mathematics) (Harding et al., 2020). Kirkman (2009) offers a unit of work as an example of a cross-curricular approach to teaching music that transcends the traditional boundaries to which Romanian pedagogy has become accustomed. This approach offers students the opportunity to access a relevant and captivating music education that embeds information from history, geography, law, and other subjects in the music classrooms.

Undoubtedly, new music technologies have changed the traditional teaching, learning, and assessment approaches, embracing a new world of performance, composition, listening, and understanding music.

Moreover, this empowerment by new physical and virtual tools and instruments can democratise the musical field. Nowadays, education without technology seems incomplete and limited.

With the advent of E-learning tools, new opportunities for teachers to provide differentiated learning without feeling overwhelmed has become available. In 2009 British Educational Communications and Technology Agency (BECTA) & National Association of Music Educators (NAfME) stated that electronic learning environments would help teachers to offer differentiated educational experiences according to the pupil's ability. It stated that ICT tools support music teachers in modelling the musical concepts they teach (BECTA, 2009). With technological support, students can learn from where they actually are, not from where the support age textbook or curriculum says they should be. Technology increases the teacher's opportunities to teach and assess students in several ways at the same time, thus responding to the diversity of students in the classroom (Elmahdi et al., 2018). Differentiated instruction can enable students to progress at their own pace and empower them to become lifelong learners. A differentiated learning approach avoids the levelling of students in education, motivating them more to progress (Palieraki et al., 2021).

2. Background

While countries such as Great Britain have made use of technology in music education since 1992, when ICT was introduced in their National Curriculum for Music, the Romanian music curriculum did not mention technology until 2017 (HMSO, 1992; MNE, 2017). As Tim Cain (2004) states, curriculum changes are necessary for the classroom to keep up with the outside world.

Since 2017, Romanian music teachers have been expected to find and choose the right E-learning tools to support their teaching. However, at the beginning of 2022, it is still a challenge for current Romanian music teachers to make appropriate use of ICT to help pupils develop their musical skills, knowledge and understanding. Issues of access, training and quality remain ongoing. E-learning resources for music teachers in the state school system are still limited or inadequate, with low support for music-specialist and non-music specialist schools. The current curriculum recommends using training applications that use the alphabetical notation systems and terminology of Anglo-Saxon countries, while Romania has always used the syllabic notation system and its own terms to define music elements (MEN, 2017).

The global crisis caused by the COVID 19 pandemic has accelerated the necessity of introducing music technology to the music education field, especially during the distance learning period. Teachers struggled and lacked the experience and time they needed to conceive new ways to deliver instruction and assignments. Students' learning paths and progression were disrupted. Suddenly E-learning tools were not an option anymore but a necessity. During the pandemic, the positive impact that information and communication technologies have brought into education, has made clear to Romanian music teachers the importance of knowing and efficiently using the available specialised technologies. The current generation of music teachers has become more willing to exploit existing technological possibilities and create new e-learning resources to support music education. The scarcity of music technology in the national language has made evident the need to create, introduce and apply innovative, intelligent e-learning tools adapted to students' needs and to the outcomes required by the Romanian music curriculum.

Research conducted at the end of 2021 related to the current use of music technologies in Romanian primary and secondary music classrooms showed that over 70% of the 170 teachers who completed the survey had never used the type of music software specified in the curricula. About 20% used it only occasionally during the online teaching period (Moldovan, 2022). The main barrier to using ICT during the teaching-learning assessment process reported by teachers was the lack of instructional software in the national language and the lack of teachers' training in use of music technologies.

In response to the current situation, we created *CantaCuMine* (https://www.cantacumine.ro/), a training software to support teachers in updating their practice in line with the outcomes requested by the current curricula (NME, 2017; NME, 2004; NME, 2005). The software is unique in Romania, designed for both music-specialist and non-music-specialist schools. The software addresses all the three pre-university levels: KS1 (year 1-4), middle school (year 5-8) and high school (year 9-12). It was used during the pandemic, and new resources are currently being developed to provide further support for music teaching.

Starting from the observation that the United Kingdom is one of the countries that have successfully used music technology in schools for a long time, we thought that in some aspects, it might be a source of inspiration and a model in the process of innovation that is imperative in the new educational context in Romania. The current music technology used in the UK education system described on the Incorporated Society of Musicians website, was an inspirational source for the study's software creation (ISM Trust, Table 5.1.; ISM, 2020; Becta&NAfME 2009; Fautley and Daubney, 2019).

In this study, we report on staff and students' experiences using the new software, discuss lessons learned, identify some of the problems that arose, and propose ways to address them.

The primary contribution of this paper is a case study from 8 schools in the real-music classroom showing how a group of students can be taught with the support of the *CantaCuMine* e-learning tool to promote and encourage active learning.

3. New technology - an alternative approach

This study aims to encourage a new teaching pattern adapted to the requirements of the new realities of music education by changing the current passive learning style in Romania. The experiment considered the use of the newly created music instruction software in primary and secondary classrooms.

In traditional music classrooms, only a small number of students participate actively: one student at a time has the chance to answer the teacher's question, while most others are passive. The instruction software trialled in this study allows the children to work simultaneously on different exercises depending on their needs and on their previous learning acquisitions. Using the software, the students benefit from practising out of school, when and where they choose, with a virtual teacher who provides instant feedback after each exercise. Through the instant feedback, the pupils' strengths and weaknesses are identified, making them aware of what they need to practice. For teachers, the materials are easy to use and to store, and this allows them time for better lesson planning. Exercises for which dozens of worksheets and many hours of marking were needed before can now be accessed and replaced, from a single page, as seen in the following image.

Figure 1: Pupils accessing exercises with all music intervals from a single web page

The software structure was planned to include a theoretical component-music theory training, an instrumental class tuition component, and a composition part. *CantaCuMine* software is currently developing resources for the instrumental class tuition and composition, two new aspects introduced in the Romanian music curriculum in 2017 that Romanian teachers seldom engage with.

The results we tracked are presented after using the theoretical part of the software, which currently includes five applications that can help students learn the following: music notes in four clefs, music intervals, music chords, keys signatures and degrees in tonalities.

4. Methodology

Sample: The research sample consisted of eight schools from different Romanian towns. Collaboration was with teachers in primary and secondary music-specialised schools who expressed their desire to use the instructional software during the music lessons. The schools involved in the experiment give a representative sample of large and small state schools.

The participants were 121 pupils and 10 teachers: The students were divided into two groups:

- Test group (group A) :(n = 60 pupils) - used the software under teacher supervision during their school music lessons for six weeks. In addition, they were required to use the software for practice at home, at least 15 minutes per day, five days a week, under teacher guidance.
- Control group (group B) :(n = 61 pupils) - used the software once a week for six weeks of school music lessons.

These two groups were balanced as much as possible in terms of the number of students involved. The teachers considered pupils' prior knowledge and abilities, so both groups were of a similar level in each school in terms of knowledge. Student scores obtained in the practice tests led by the class teachers measured prior knowledge and skills.

At the beginning of the testing period, each child was allocated a unique code (to ensure anonymity), which enabled the researcher to observe the students' learning progress during the experiment.

The distribution of codes by teachers to students has remained confidential, with no access for the researcher to any code associated with a particular student. Group A received the access code at home, while group B was advised to use it during the testing period only in the classroom.

5. Findings

This study demonstrates that the first group, which used the tool constantly for six weeks, learned better than group two, which followed the traditional learning paradigm for home practice and used the software only during their music lesson. The access codes were distributed as shown in Table 1.

Table 1: Codes access distribution in schools

Town	Bucuresti	Sibiu		Deva		Sighet	Botosani	Braila	Vatra Dornei	Reghin
		T1	*T2*	*T1*	*T2*					
n=group A	7	7	7	8	8	5	5	5	4	4
n=group B	6	7	7	7	7	6	5	5	5	5

This distribution might not be ideal for the following reasons:

- Some students from the control group (n=3) frequently accessed the platform at home starting with week two and could not be assigned to an arbitrary group due to the number of times they accessed the software.
- There were some students in group A (n=2) who did not access the software regularly and had provided less data than required, so these were not taken into account.

Means of data collection: An online questionnaire with open and closed questions to collect both quantitative and qualitative data was designed for all the ten teachers in each school. At the end of the testing period, all 121 students who participated in the software testing were also invited to answer a set of questions. Their answers reflected their opinion on the software and the advantages and limitation observed. The main tracked data that reflects the students' activity was extracted through the access codes that had enabled the researcher to observe their use of the software.

6. Experimental setup

The software was presented at the beginning of the experiment to the teachers involved. They received some instructions on how to use the software but reported that the software is intuitive, and no special training is required. The next step for teachers was to plan their lessons with the software for six weeks. Each teacher approached during the music lessons the application/s they needed according to the subjects taught during the testing period.

Table 2: Applications approached by each school

Town	*Applications approached*				
	Notes	Intervals	Chords	Key Signatures	Degrees
Bucuresti		x	x		
Sibiu		x	x	x	x
Deva		x	x	x	x
Sighet	x	x			
Botosani	x				x
Braila			x	x	
Vatra Dornei	x				
Reghin	x				

The experiment involved teaching one music element of new material and immediately giving the learners related exercises to practice. This approach enabled teachers to work with a new pattern of teaching, which was beneficial to both students and teachers. Learners could test their understanding of the taught concepts straightaway. Based on students' answers, teachers could measure the level of understanding of the taught material. Mixing theoretical explanations with interactive exercises benefits long-term recall. During the testing period, we followed the pattern shown below.

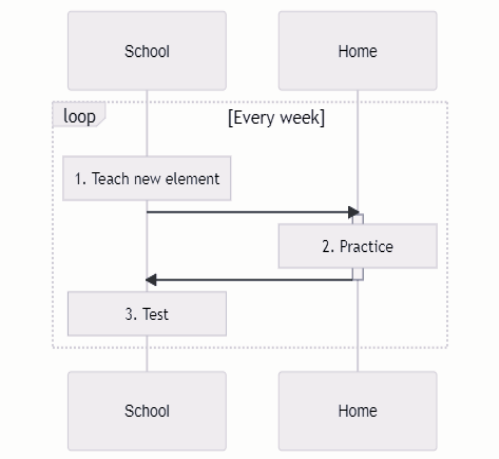

Figure 2: The pattern followed during the six weeks of testing the theoretical part of the software

In the first week after the software presentation, pupils were taught new element/s during the music lessons according to the music syllabus for their year group. Groups A and B were invited to use the platform during the lessons to practice the new element/s under teacher supervision. Group B mixed traditional methods (worksheets) with the software during the music lesson, while group A used only the software for practice. All 121 participants could practice the exercises individually during the class and access a test when they decided to check their progress. Group A was asked to use the software for at least 15 minutes per day, five days a week, for home practice. Group B followed the traditional method and received worksheets that covered exercises for about 15 minutes plus some challenges for those who wanted to work more. At the beginning of the second lesson, pupils tested their knowledge from their previous lesson of the week before and were then taught a new lesson/element which was practised using the software in groups as described above.

The tests were structured in packages of ten. After completing each question, all the students had instant access to the test results, which showed them exactly their weaknesses and strengths, pointing out which elements they were still missing and needed to work on to progress. This pattern was held for the whole period of six weeks.

Firstly, it was necessary to see if the number of correct answers during the performed tests every week for both groups was identical or not. If the results were similar, that would mean that *CantaCuMine* software had not introduced any changes. Then the final tests were analysed. These included all the music elements taught and practised during the testing period with *CantaCuMine* software. These tests helped compare the two groups' final performances considering all the elements they had practised during the test period. It should be

noted that new elements were added to the previous ones every week. So, all tests included all the elements taught during the weeks since the experiment had started.

7. Results

The following diagrams show the average mark from the whole of each group

7.1.1 Notes training application

Group A's average answers were between 8.47 and 9.07, while group B's average answers scored between 6.33 and 6.72, as shown in the following diagram.

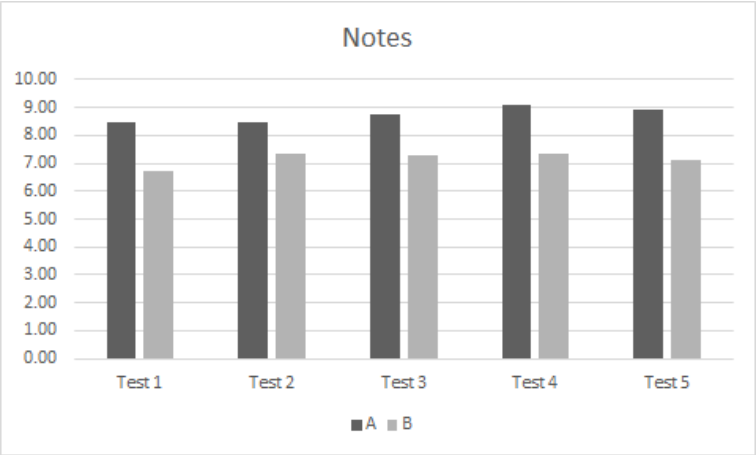

Figure 3: Pupils' average correct answers in the tests performed during the six weeks with the note training application

7.1.2 Intervals training application

Group A's average answers were between 8.43 and 9.07, while group B's average answers scored between 6.61 and 7.18, as shown in the following diagram.

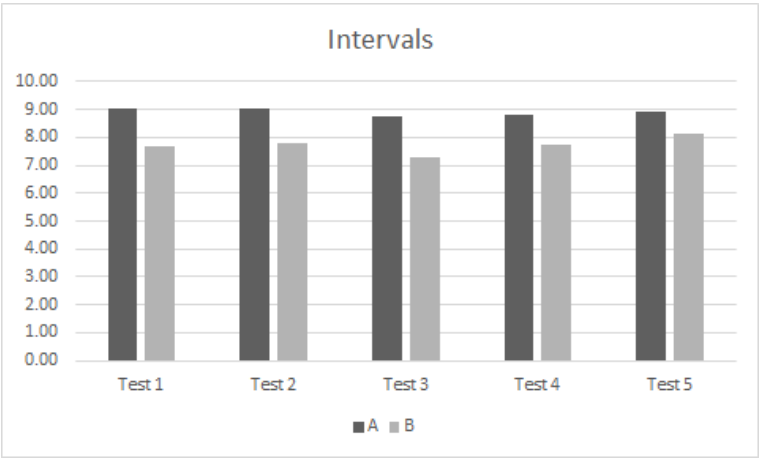

Figure 4: Pupils' average correct answers in the tests performed during the six weeks with the intervals training application

7.1.3 Chords training application

Group A's average answers were between 8.43 and 8.60, while group B's average answers scored between 6.37 and 6.66 as shown in the following diagram.

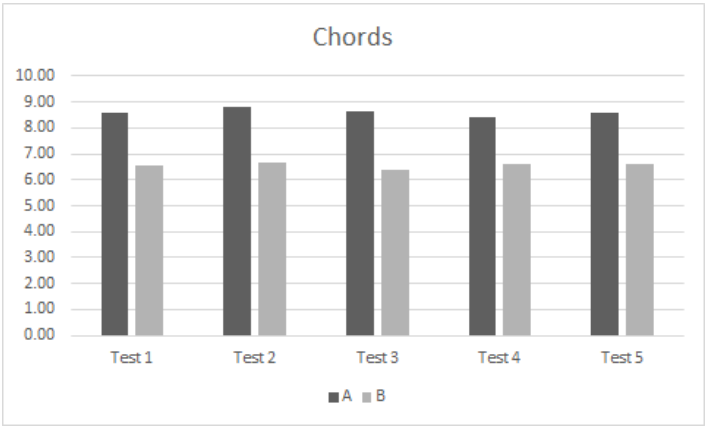

Figure 5: Pupils' average correct answers in the tests performed during the six weeks with the chords training application

7.1.4 Key signature training application

Group A's average answers were between 8.49 and 9.30, while group B's average answers scored between 7.88 and 8.93 as shown in the following diagram.

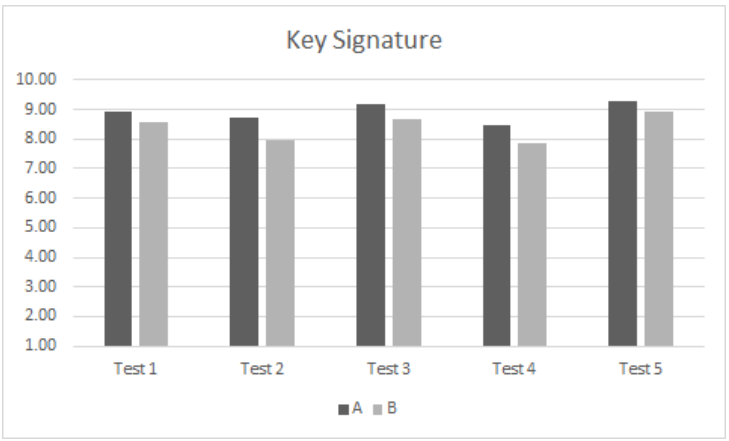

Figure 6: Pupils' average correct answers in the tests performed during the six weeks with the key signature application

7.1.5 Scale degrees training application

Group A's average answers were between 8.26 and 8.67, while group B's average answers scored between 6.87 and 7.75 as shown in the following diagram.

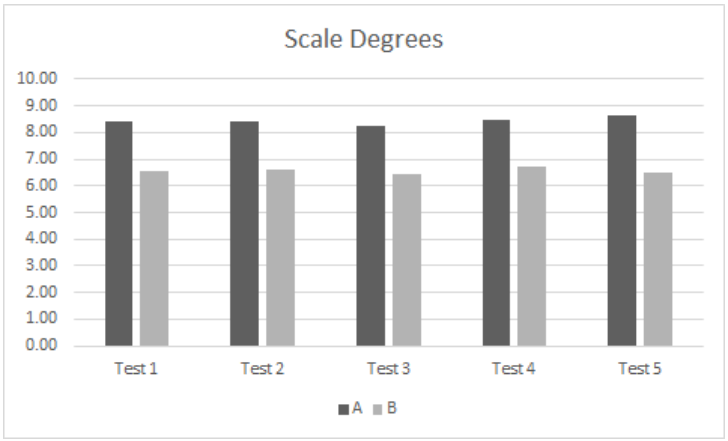

Figure 7: Pupils' average correct answers in the tests performed during the six weeks with the note training application

8. Staff and students' experiences using the software CantaCuMine

In the questionnaire completed by the students who participated in the software testing, 100% of the 121 reported that they enjoyed the experience of using the software during the music classes and said that they wanted to continue to use the software in their home practice. 96.6% reported that they felt highly motivated by the software marking with 5 on a scale of 1 to 5, their motivation and active involvement through the software usage. 97.5% considered that their being able to choose the exercises (according to their needs and previous learning acquisitions) was extremely useful. 98.3% of students in Group A considered it an excellent opportunity to practice where and when they chose. The 121 students unanimously appreciated the possibility of accessing immediate feedback. 94% reported that the software was easy to learn and use.

The ten teachers who managed the software testing reported that the software offered the opportunity to better plan the time allocated to the acquisition of the musical elements they wanted to cover. All ten teachers noticed improvements in students' knowledge following the use of the software during the music lessons. They all reported better results in students who practised at home with the software compared to those who continued to work at home with traditional methods. Teachers stated that the software was not only helpful in teaching but also to motivate them. "I saw them captivated and eager to work with technology. The software totally aroused their interest", reported one of the teachers. "They are eager to achieve a higher score than the previous one; have a higher motivation and a great pleasure to continue training themselves with the software", reported another teacher. Eight of the ten teachers involved remarked that the software engaged students in peer learning, noticing that the exercises generated group discussions. Six teachers reported that students perceive the exercises as games and reported that the software offers students an attractive and dynamic learning environment. "Students are more focused, enthusiastic, and eager to learn", reported another teacher.

All the teachers confirmed that the new teaching approach raised their awareness of each of their students' levels of comprehension of the taught material, helping them adjust their teaching process. "I had continual feedback from the students, so I knew exactly which activities I should insist on", reported one of the teachers. "I was able to adapt things on the go knowing what the students understood and what they didn't", reported another teacher. All the teachers involved in software testing decided to continue using the software during school music lessons and home practice.

CantaCuMine software is also proposed to support active learning educational scenarios, including online teaching or a hybrid approach. During the six weeks of the experiment, three of the pupils from group A who missed a lesson in person due to illness were able to connect on the Google classroom platform to access the lesson they had missed. They managed to do the expected exercises on the software during the hybrid lesson. In addition, they could keep accessing the software at home for 15 minutes following the teacher's explanation.

9. Conclusion

Innovative approaches to digital devices can make learning more attractive and improve learners' performances. The involvement of music technologies in music education has opened new opportunities for the current generations of Romanian music teachers.

Following this experiment, we can conclude that the use of the *CantaCuMine* software enhanced students' learning outcomes, positively affecting learners' motivation. Students became more eager to learn, more enthusiastic, and more focused when using technology-mediated music education.

The use of pilot schools in which students and teachers test the newly created resources to provide immediate feedback on the content is ideal. In this way, adjustments can be made following constructive discussions regarding the contents and its display.

Starting with the next academic year, the software will be offered for widespread use in Romanian schools.

At present, *CantaCuMine* software develops resources for instrumental class tuition and composition; the next step in our research is to test and track the results of using them in a larger potential sample of school settings. We also intend to continue developing and testing more applications for the theoretical component in the

future. Undoubtedly, the positive effect of technology on music education in Romania will increase as technologies are developed and used responsibly and maturely. In this way, the current generation of teachers will expand the traditional opportunities for students to engage in music.

Some Fears and Misconceptions

Many teachers fear that computers can take away the teachers' role in the future and therefore they dismiss their use out of hand. In so doing, they and their students may miss on the potential benefits. This is compounded by a vague idea that computers will de-humanise and take over the relationships with their classes and students they have enjoyed for many years. The teachers who want to incorporate technology in their teaching-learning-assessment process can potentially benefit from good quality support in their training. More than this, the teachers involved in this project reported that this tool opened their minds to consider the teaching and learning process in previously unexplored ways.

Following the results we tracked during this experiment, we decided to translate the software into English *AllegroNotes* (https://www.allegronotes.com/) so more pupils could access its content.

Limits and challenges

There were situations when computers met internet connection difficulties in class, and teachers had to either restart the computer or offer the pupils another device. Although the software was built with a responsive design, the display for devices less than 7 inches is not recommended due to the number of elements needed to be shown on a page. Some of the pupils accessed the software from mobile devices for their home practice and noticed the inconvenience in the display.

References

British Educational Communications and Technology Agency & National Association of Music Educators, (2009) *Secondary Music with ICT: A pupil's entitlement to ICT in Key Stage 3 music,* [ebook] p. 2,3. Available at: http://archive.teachfind.com [Accessed 12 Sept. 2021].

Cain, T., (2004) *Theory, technology and the music curriculum*, B. J. Music [online] Ed21:2, 215–221 Copyright Cambridge University Press, Available at: DOI: 10.1017/S0265051704005650 [Accessed 19 Sept. 2021].

Condie, R., Munro, B., Seagraves, L., and Kenesson, S., (2007) *The impact of ICT in schools - a landscape review*,

Cooper, L., (2007) *The Gender Factor: Teaching Composition in Music Technology Lessons to Boys and Girls in Year 9* in Music Education with Digital Technology, London-New-York, Continuum International Publishing Group, pp.30-40.

Elmahdi, I., Al-Hattami, A., and Fawzi, H., (2018) *Using Technology for Formative Assessment to Improve Students' Learning,* The Turkish Online Journal of Educational Technology, volume 17, issue 2, pp. 182-188.

Fautley, M., and Daubney, A., (2019). *The national curriculum for music - A revised framework for curriculum, pedagogy and assessment across primary music*, Incorporated Society of Musicians. Available at: https://www.ism.org/images/images/ISM_The-National-Curriculum-for-Music-booklet_Primary_2019_digital.PDF [Accessed 18 April 2022].

Fautley, M., and Daubney, A., (2019) *The national curriculum for music"- A revised framework for curriculum, pedagogy and assessment across KS3,* Incorporated Society of Music. Available at: https://www.ism.org/images/images/ISM_The-National-Curriculum-for-Music-booklet_KS3_2019_digital.pdf [Accessed 18 April 2022].

Harding, P., and Ward, D., (2020) *National Plan for Music Education 2020, Music Technology enhances all Music Making. A JAMES Creative and Educational Proposal,* [ebook] http://www.gatewaypdt.com/resources/JAMES-Music-Technology-in-Education-2018-discussion-Doc.pdf [Accessed la 22.10.2020].

Her Majesty's Stationery Office (HMSO) (1992) *Music in the National Curriculum (England)* Available at: https://www.ism.org/images/files/Music-in-the-NC-1992.pdf [Accessed 12 March 2022].

Incorporated Society of Musicians, *What's the latest in Music Technology?* [online] Available at: https://www.ism.org/blog/whats-the-latest-in-music-technology [Accessed 20 May 2022].

Incorporated Society of Musicians, *Using technology in Primary Music Education,* Available at: https://www.ismtrust.org/resources/primary-toolkit/using-technology-in-primary-music-education/technologies-useful-in-music-education [Accessed 20 May 2022].

Innes, K., (1997) *Using Technology at Key Stage 3,* paper presented at the British Educational Research Association Annual Conference. Available at: http://www.leeds.ac.uk/educol/documents/000000329.htm [Accessed la 22.10.2020].

Kirkman, P., (2009) *Embedding Digital Technologies in The Music Classroom: An Approach for the New Music National Curriculum,* Creative Commons License, Available at: http://www.jsavage.org.uk/jsorg/wp-content/uploads/2013/09/phil_kirkman.pdf [Accessed 12 March 2022].

Klasnja-Milicevic, A., and Ivanovic, M., (2018) *New Flavor and Benefits for Educational Environments Informatics in Education,* Learning Analytics, Vol. 17, No. 2, pp. 285–300, Vilnius University, DOI:10.15388/infedu.2018.15

Martinez-Argüelles, M.J., Batalla-Busquets, J.M., Noguera-Guerra, P., and Pons-Fanals, E., 2011, *Personalized e-Feedback and ICT*. In Proceedings of the 10th European Conference on E-Learning: ECEL (p. 456). Academic Conferences Limited.

Ministry of National Education order no. 3393 / 28.02.2017, Music programs for music-specialised and non-music specialised schools, pp. 1-21 http://programe.ise.ro/Portals/1/Curriculum/2017-progr/63-Educatie%20muzicala.pdf [Accessed 12 March 2022].

Ministry of National Education Instruction of 21 April 2020 for creating and/or strengthening the capacity of the pre-university education system through online learning. Available at: https://legislatie.just.ro/Public/DetaliiDocumentAfis/224976 [Accessed 12 March 2022].

Moldovan, M., (2022) *Current Music Technology usage across Romanian primary and secondary music classroom*, ICT in Musical Field vol 13, pp. 23-32.

Palieraki, S., and Koutrouba, K., (2021) *Differentiated instruction in information and communications technology teaching and effective learning in primary education*, European Journal of Educational Research, Volume 10, Issue 3, pp. 1487 - 1504, doi: 10.12973/eu-jer.10.3.1487

Quality in Education Centre, University of Strathclyde, BECTA research, [ebook] p.4,25. Available at: https://oei.org.ar/ibertic/evaluacion/sites/default/files/biblioteca/33_impact_ict_in_schools.pdf [Accessed 12 March 2022].

Savage, J., (2007) *Pedagogical Strategies for Change in Music Education with Digital Technology*, London-New-York, Continuum International Publishing Group, pp.142-155.

Tacoma, S., Drijvers, P., and Jeuring J., (2020) *Combined inner and outer loop feedback in an intelligent tutoring system for statistics in higher education,* Journal of Computer Assisted Learning, pp 1–14. https://doi.org/10.1111/jcal.12491

Valdivia, T., Renzo, F., Calsina, P., Wilber, C., and Valasco, R. B., (2021) *Musical software in the teaching-learning of Music students of the National University of the Altiplano Puno,* Comuni@cción [online]. vol.12, n.1, pp.25-36. ISSN 2219-7168. http://dx.doi.org/10.33595/2226-1478.12.1.471

Wong, G-W., and Yang, M., (2017) *Using ICT to Facilitate Instant and Asynchronous Feedback for Students' Learning Engagement and Improvements*, Emerging Practices in Scholarship of Learning and Teaching in a Digital Era, Springer, Singapore. https://doi.org/10.1007/978-981-10-3344-5_18

Work in Progress Papers

Designing a Curriculum for Digital Competencies Towards Teaching and Learning

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Abstract: The COVID-19 pandemic initiated a fundamental change in learning and teaching in (higher-) education [HE]. On short notice, traditional teaching in HE suddenly had to be transformed into online teaching. This shift into the digital world posed a great challenge to in-service teachers at schools and universities, and pre-service teachers, as the acquisition of digital competences was no longer an option but a real necessity. The previously rather hidden or even neglected importance of teachers' digital competences for successful teaching and learning became manifest and clearly visible. In this work, we investigate necessary digital competences to ensure high quality teaching and learning in and beyond the current COVID-19 pandemic. Based upon the European DigComp 2.1 (Carretero et al., 2017), DigCompEdu (Redecker, 2017) frameworks, the Austrian Digi.kompP framework (Virtuelle PH, 2021), and the recommendations given by German Education authorities (KMK 2017; KMK 2021; HRK 2022), we developed a curriculum consisting of 5 modules: 2 for individual digital media competence, and 3 for media didactic competence. For each module, competence-oriented learning goals and corresponding micro-learning contents were defined to meet the needs of teachers while considering their time constraints. Based on three online workshops, the curriculum and the corresponding learning goals were discussed with university teachers, pre-service teachers, and policymakers. The content of the curriculum was perceived as highly relevant for these target groups; however, some adaptations were required. From the university teachers' perspective, we got feedback that they were overwhelmed with the situation and urgently needed digital competences. Policymakers suggested that further education regarding digital competences needs to offer a systematic exchange of experiences with peers. From the perspective of in-service teachers, it was stated that teacher education should focus more on digital competences and tools. In this paper, we will present the result of the workshop series that informed the design process of the DIGIVID curriculum for teaching professionals.

Keywords: digital literacy, digital competences curriculum, online teaching and learning

1. Introduction

The COVID-19 pandemic initiated a fundamental change in learning and teaching in HE, suddenly transforming education into online teaching, challenging in-service teachers at schools and universities, and pre-service teachers with an urgent acquisition of digital competences.

Keeping this as a starting point for our work, our goal is to support pre- and in-service teachers and university teachers in acquiring and developing digital key competences to improve their (inclusive) online teaching and learning. Therefore, we investigated existing curricula including the European DigComp 2.1 (Carretero et al., 2017), DigCompEdu (Redecker, 2017) frameworks, the Austrian Digi.kompP framework (Virtuelle PH, 2021), and developed a curriculum consisting of 5 modules: 2 for individual digital media competence, and 3 for media didactic competence. For each of the modules, we developed a set of topics, linked to well-formulated learning goals. Learning goals are seen as a key factor for effective and successful teaching (Marzano, 2010; Stronge, 2018) as they describe what a learner should be able to do after a specific learning experience. Additionally, learning goals can serve as a guideline of what to learn to complete a course (Bloom, 1956; Krathwohl & Anderson, 2010; Mager, 1962).

In this paper, we present the results of three workshops conducted with university teachers, policymakers, and pre-service teachers. The goal of the workshops was to get insights about the current challenges and needs for

high quality education, and to get feedback for our curriculum, thus, answering the research question: Which digital competences are necessary for pre- and in-service teachers and university teachers to ensure high quality teaching and learning in the virtual world?

2. Methodology

Procedure: We conducted three online workshops. The first workshop (WS1 - 09/21 - co-located with the EC-TEL conference) was held with university teachers and the second workshop (WS2 – 11/21) with policy makers. Both workshops were set up in the same way, in that we gave the participants an overview about the five planned modules and discussed the proposed topics with them. The third workshop (WS3 – 02/22) was conducted with pre-service teachers providing them with an overview of the modules, the respective topics, and the corresponding learning goals.

Method: WS1 was conducted via Zoom, while WS2 and WS3 were conducted via WebEx. For each workshop, we prepared an individual MIRO board (https://miro.com/ - MIRO is an online digital whiteboard) consisting of the following areas: (1) an agenda, an introductory part to set the stage and make the participants familiar with MIRO. (2) The module part, where we briefly presented the modules and invited for discussion. (3) The feedback part asking our participants for feedback regarding the workshops and activities done.

Participants: In WS 1, three university teachers (2 Germany, 1 Belgium) participated. WS 2 was attended by two policymakers (1 Austria, 1 Germany), and in WS 3, we had 8 pre-services teachers (4 Austria, 4 Germany).

3. Results

In WS1, the participants highlighted the following competence needs. In the first lockdown they stated that teachers were overwhelmed with the situation. The participants mentioned that they would need more Moodle competency, and especially experts that support teachers in using Moodle regarding available tools and features. Additionally, they referred to a lack of competences on how to do digitally supported (summative) assessments in education staff. Moreover, the lock-in effect - namely knowing one tool is fine but they are not able to transfer this knowledge to another tool - was mentioned. Regarding the DIGIVID curriculum, they would like to have a curriculum with basic information literacy, deeper insights into technology, and knowledge about why which type of technology is useful for teachers.

In WS2, on a meta-level, the policymakers stated that there is an urgent need to promote teachers' basic didactic understanding, including didactic models in relation to digital online teaching and learning. Thereby, a focus should be put on the differences to traditional views. Regarding the DIGIVID curriculum, one topic of crucial relevance is to make copyright and data protection clear in the development of tools and content. And finally, they suggested establishing a kind of "community of practice for teachers" for exchanging experiences and for the transfer into practice as "*practice is important for the teacher and increases confidence and their repertoire*".

In WS3, we asked pre-service teachers for their competency needs regarding their experience from their educational perspective as a student and from their practical perspective as a teacher. From their educational perspective, they needed knowledge on how to deal with programs, including relevant opportunities and risks. One participant stated: "*It is assumed that everyone can do everything and use the tools without any problems*". They would like to know how to make digital teaching safer, and what challenges and pitfalls exist in this regard. From their practical perspective, i) they would like to know how they can teach digital skills to children in distance education, ii) they wish to use different digital tools for designing a lesson, and iii) they would like to embed digital competences for formulating digital learning objectives in the curriculum or school. Regarding the modules of the curriculum, we received the following suggestions. For Module 1 - Basic Computer Literacy - on the topic information search, they highlighted the transfer into practice and opt for search exercises. Regarding the topic of communication and collaboration, they would like to learn more about online clouds including sharing and privacy aspects. For Modul 2 – Reflecting on Digital Lifeworld - they suggested practice-relevant areas, such as emerging phenomena and real problem cases, role models and possibilities for (self-) reflection. Regarding Modul 3 – Designing Digital Materials - they highlighted the topic of licenses, especially regarding "*what content am I allowed to digitize at all*". Finally, for Modul 4 – Teaching and Learning with Digital Media – they stated that there exist a huge variety of tools in the internet and in terms of

this variety, they would like to know what exactly they can do with what and, most importantly, *"how fast and simple it can be done in the classroom".*

4. Discussion

The workshop results confirmed that the sudden shift from traditional teaching to online learning and teaching was difficult and has raised the urgent need for the acquisition of digital competences. Regarding our curriculum, we received valuable insights: First, in all workshops the participants stated that there is a need to not only provide theoretical knowledge but also to transfer this knowledge into practice. This means to offer educators a kind of community of practice and time for reflection. We are aware that this is not something that could be directly included in our curriculum per se. Yet, we will insert in the curriculum beside factual knowledge but also practice-related tasks. The second identified relevant topic deals with licenses, copyright, sharing and data protection. Therefore, we will add this topic as a focus topic in our curriculum. Third, to support educators while teaching, we add a toolbox consisting of different tools (related to specific topics) from which they can choose what they need for their online teaching.

Limitations: Due to COVID-19, the number of our workshop participants was rather low. In WS 1, only 3 out of 20 officially enrolled participants participated. However, the results show that our curriculum goes in the right direction, but more in-depth analysis is needed to confirm the usefulness of the curriculum for conveying basic digital competences for teaching and learning.

5. Conclusion

In this paper, we presented the results of three workshops to improve the DIGIVID Curriculum, a curriculum that supports in- and pre-service teachers and university teachers in acquiring digital competences for teaching and learning. The results show that our 5 modules of the curriculum seem to be very promising for our target groups. We received valuable feedback on how to improve the curriculum, such as i) to bring theory into practice (e.g. a community of practice), ii) focusing on a topic covering licenses, privacy, security, and data sharing, iii) to offering different tools that can be applied into lectures. Nevertheless, the content of the curriculum is kept that general so that it can be used by other educators as a baseline for teaching digital competences where applicable.

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References

Bloom, B. S. (1956) Taxonomy of educational objectives: The classification of educational goals. Cognitive domain.

Carretero, S., Vuorikari, R., and Punie, Y. (2017) "The digital competence framework for citizens." Publications Office of the European Union.

HRK (2022) „Lehrer:innenbildung in einer digitalen Welt – Empfehlungen der Hochschulrektorenkonferenz." Entschließung des 150. Senats der HRK am 22. März 2022 in Berlin.

KMK (2017) „Strategie der Kultusministerkonferenz „Bildung in der digitalen Welt". Beschluss der Kultusministerkonferenz vom 08.12.2016 in der Fassung vom 07.12.2017.

KMK (2021) „Lehren und Lernen in der digitalen Welt". Die ergänzende Empfehlung zur Strategie „Bildung in der digitalen Welt".

Krathwohl, D.R. and Anderson, L.W. (2010) "Merlin C. Wittrock and the revision of bloom's taxonomy." Educational psychologist, Vol. 45, No. 1, pp 64-65.

Mager, R.F. (1962) Preparing instructional objectives.

Marzano, R.J. (2010) Designing & Teaching Learning Goals & Objectives. Solution Tree Press.

Redecker, C. (2017) "European framework for the digital competence of educators DigCompEdu" (No. JRC107466). Joint Research Centre (Seville site).

Stronge, J.H. (2018) Qualities of effective teachers. ASCD (2018).

Virtuelle PH (2021) „Digi.kompP: Digitale Kompetenzen für Pädagoginnen und Pädagogen". Eisenstadt: Virtuelle PH.

Designing for Blended Learning Approaches for Sustainable Attitudes and Actions

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Abstract: As part of the call for action to protect the planet, an increase of interest in applying topics on Sustainable Development Goals (SDGs) into education has been evident in recent years. The agenda calls for transformative Education for Sustainable Development (ESD) which allows learners to achieve knowledge and skills to influence values and attitudes as well as enable individual and collective sustainable actions towards society and the planet. In this work in progress paper the Learning design workshop, developed for supporting educators in designing blended learning for ESD, is presented and discussed. The Blend for ESD framework (B-ESD) is developed based on a literature study and observations from a blended learning course on developing ESD competencies for educators in higher education. Findings showed challenges in how to design for ESD in a blend between online and on-site settings. The Learning design workshop is conducted with inspiration from card-based facilitation methods to support educators in designing for learners to achieve knowledge and inspire for sustainable attitudes and actions. The workshop consists of four stages addressing: *Why*, *who*, *what* and *how,* where educators are inspired and supported in the process of identifying subjects to address within sustainability and making pedagogical informed decisions on the usage of online resources to support and supplement on-site learning activities. Findings from the initial iteration showed that the learning design process supports the educators in navigating and acting in the complexity of designing ESD.

Keywords: learning design, education for sustainable development, blended learning, online learning

1. Introduction

A sustainable future encompasses "*humanity´s ability to ensure sustainable development, that meets the needs of the present without encompassing the ability of the future generations to meet their own needs"* (Keeble, 1988). Education is identified as one of the key forces central to the processes of sustainable development, where fostering active, critical, and independent citizens, who are able to find democratic solutions to problems and challenges connected to sustainable development is pivotal. In 2015 the 17 SDGs were introduced, where SDG 4.7 in which ESD is anchored, is considered an enabler of them all (UN, 2015). With ESD, it is sought to develop knowledge and skills, as well as influence values and attitudes and enable sustainable actions towards society and the planet. In order to pursue this global goal of designing for ESD, it is of key importance to investigate how ESD unfolds in real educational practice. In this paper we present and discuss a framework for a learning design approach for supporting educators in designing for ESD as a blended learning approach.

2. Blended sustainable education

It has been argued that, blended learning has the potential to promote lifelong education, with the sustainability in blended learning depending on a suitable design and management of learning materials and practices, to meet the needs of present and future users (Chen, 2022). Blended learning is an approach to ESD that can encompass a holistic and transformational approach that enables a learner-centred approach, self-directed learning, action-oriented pedagogy and yield a learning environment with possibility of participation, collaboration and formal and informal learning (Rieckmann, 2018). With the need for education to be flexible and adaptable to different contexts and changing societies, digital technologies enables communication, collaboration and learning across distance and have potentials on local, national and global scale (UNESCO, 2020). Blended learning has a sustainable potential regarding time and space for both educators, students and collaborators. The blended learning design gives rise to a flexibility that can be adapted to the *who*, being different learners and to different education contexts and it can easily be updated if necessary. Online resources, such as podcasts, videos etc. allows for learners to engage with them in their own pace, enabling a possibility to differentiate to meet the needs of the individual learner.

Sustainable psychology and pedagogy, strains that it is important that sustainable development needs to focus on hope and opportunities of actions "close to home" and that people's willingness to live and act pro-

sustainable is affected by their belief that it will affect their well-being positively (Nygaard, 2019). Multimodality is also an important element when designing for ESD and should include learning activities and experiences that allows exploration of multisensory real world experiences and develop skills to engage creatively and innovatively for sustainability transformations (Heinrichs, 2021). With blended learning it is possible to have on-site learning activities, but also online activities that the students can carry out in their situated learning setting, bearing in mind, that learning environments is where learners learn what they live and live what they learn. Hence leading to address: How can educators be facilitated in designing blended ESD courses, based on pedagogical informed decisions regarding use of ICT?

3. Method and approach

The methodological approach that has been used to form concepts and the learning design framework "Blend for ESD" (B-ESD) presented in this paper is inspired by Design-Based Research (Barab and Squire, 2004). Through literature studies, a field study and an intervention in collaboration with educators we aim for improving contextually-sensitive design principles and concepts for ESD. Due to the rising demand for ESD we were oriented toward creating new knowledge on how to design and scaffold student-centred learning on SDGs and sustainable development through a blended learning approach.

The initial stage of the project was conducted as a field study on the course Circular Economy and Sustainable Development Education (CESDE) (Østergaard et al., 2022), in the fall 2021. The purpose was to gain context-specific insights on designing for ESD. Through the participation in the course qualitative data was collected in the form of participation observations. One of the researchers was enrolled in the course, hence having a double role acting as both a course participant and researcher, while the two others were strictly researchers observing during the course. This gave rise to both passive participation and moderate participation. The main purpose was to gain knowledge on how the course was organized and conducted and how the course participants engaged in the course towards designing for ESD. Hence observing on how the course participants verbally and nonverbally connected with the academic content and activities of the course. Furthermore, the course educators shared planning documents, course material and their reflections on the course. In continuation of the course five semi-structured interviews with course participants were conducted, to explore thoughts on their course experiences. Informed by a literature study on learning design and SDGs and sustainability, the analysis on the empirical data from the field study and interviews on ESD in practice, the B-ESD framework was designed. The iterative principle was unfolded in a following workshop intervention.

The CESDE course goal was to facilitate a "lifelong learning processes" amongst educators regarding sustainable development, to improve the overall ESD in the organization. It consisted of an online kick off day and 4 following on-site workshops, at different internal and external locations, with real-life hands-on experiences (Østergaard et al., 2022). In the continuous efforts to develop the course regarding methodology, partnerships, theory and practice, a collaboration with VIA Research Program for Learning and Digital technologies was established. The aim of the design intervention was to support the course educators in designing a blend for ESD, with the B-ESD framework giving a language for and operationalization of the category's knowledge, attitudes and actions and to make pedagogically informed choices regarding usage of ICT.

4. Design workshop interventions – why, who, what and how?

Learning design can be seen as a systematic methodology oriented towards supporting educators in making pedagogical choices and principles for designing learning opportunities involving ICT (Conole, 2014; Mor et al., 2013). B-ESD as illustrated in figure 1 is the frame for the workshop for educators to reflect, explicit and share perspectives on why, who, what and how to design for ESD. The first stage addresses why. The course educators reflected and identified overall objectives for the design. The second stage focuses on who are the learners. In this stage the educators were asked to draw an illustration and write a short narrative on who they are designing for. The third stage what aim for the educators to identify and sort topics for the course. They were facilitated in filling in post-it's to identify and sort their ideas and topics using the three categories; Knowledge, which relates to understanding concepts, knowing facts and thinking skills. Attitudes relating to real-life sensory experiences and discussions that influence values and attitudes and hence possibly foster sustainable actions. Actions, which are necessary for sustainable development and only happens where there is the opportunity to take action (Rieckmann, 2018). These originates from the three domains the cognitive, socio-emotional and behavioural domain of learning objectives applied to the SDGs (UNESCO, 2017).

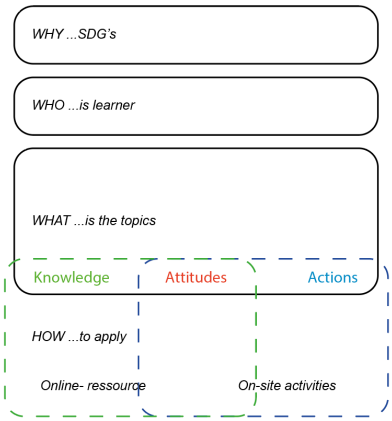

Figure 1: Illustration of the B-ESD framework

Based on the identified ideas and topics within the *what* sorted by the categories knowledge, attitudes and actions, the fourth and final stage *how* was conducted with inspiration from the CoED method (Georgsen and Nyvang, 2007). The process supported the educators in discussing and making informed decisions on which on-site activities and online resources, such as podcasts, discussions, video etc. to be developed and/or applied.

5. Findings and discussion

Findings from the intervention workshop pointed towards a diversity in arguments for *why* designing for ESD and if the *why* were of personal and/or professional nature. It brought on reflections on if changing attitudes in the course participants personal lives, could move them towards implementing ESD in their teaching practice. During the second stage, it became apparent that *who* was a diverse group, which brought on further reflections on the *what* and *how*. The B-ESD framework supported reflections, identifying and sorting the *what* of the course, using the categories knowledge, attitudes and actions and aided in discussion and reflections on online versus on-site activities. It aided in cementing that lectures by sustainability experts and on-site real world experiences were important (Heinrichs, 2021). Actions focused on personal initiatives, such as not buying pre-rapped food and the initiation of an action in the course participants teaching practice. *What* revealed that knowledge content regarding sustainability and ESD could be presented as online resources. In addressing the *how* the course educators were facilitated in making pedagogical informed choices on usage and designing of the online resources. The B-ESD framework is a work in progress and further iterations on the design workshop is needed.

References

Barab, S., Squire, K., 2004. Design-Based Research: Putting a Stake in the Ground. Journal of the Learning Sciences 13, 1–14.

Chen, R.H., 2022. Effects of Deliberate Practice on Blended Learning Sustainability: A Community of Inquiry Perspective. Sustainability 14, 1785.

Conole, G., 2014. The 7Cs of Learning Design – a new approach to rethinking design practice. 8.

Georgsen, M., Nyvang, T., 2007. Collaborative e-Learning Design Method (CoED) (No. 12), e-Learning Lab Publication Series. Aalborg University, E-Learning Lab.

Heinrichs, H., 2021. Teaching Sustainable Development in a Sensory and Artful Way—Concepts, Methods, and Examples. Sustainability 13, 13619.

Keeble, B.R., 1988. The Brundtland report: 'Our common future.' Medicine and war 4, 17–25.

Mor, Y., Craft, B., Hernández-Leo, D., 2013. The art and science of learning design. Research in Learning Technology 21.

Nygaard, S.E., 2019. Sustainability Psychology: On the Relation Between Environmentally Sustainable Living and Subjective Well-being: PhD Dissertation (PhD Thesis). Aarhus BSS, Aarhus University, Department of Psychology and Behavioural Sciences.

Østergaard, T., Sack-Nielsen, T., Nielsen, B.W., Marcussen, B.H., Frederiksen, K., 2022. Learners Learning to Become: Exploring Experiences with Developing Educators ESD-Competencies Across Sectors at a University of Applied Science / Higher Education. Futures of Education, Culture and Nature - Learning to Become 1, 102–117.

Rieckmann, M., 2018. Learning to transform the world: key competencies in education for sustainable development, in: Issues and Trends in Education for Sustainable Education.

UN, 2015. United Nations Sustainable Development Goals.

UNESCO, 2020. Education in a post-COVID world: Nine ideas for public action.

UNESCO, 2017. Education for Sustainable Development Goals: learning objectives.

Artificial Intelligence to Improve Learning Outcomes Through Online Collaborative Activities

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Abstract: A key strategic objective of the University courses is the promotion and development of new and innovative teaching activities, also through the e-learning environment, with the aim of providing students with direct involvement in the learning process. Collaborative activities represent important and effective teaching methodologies that allow the improvements of learning outcomes through active learning. Furthermore, they can allow the development of soft skills because they enable learners to work together and practice critical reflection and conflict negotiation. Recently, online learning environments are being used to design and deliver assignments based on student work groups. Indeed, the development of digital technologies allows the organization of these online activities in a flexible way for both students and teachers. The goal of this work is to develop successful collaborative activities for undergraduate students to ensure the improvement of knowledge and soft skills on a specific topic. One of the fundamental factors that influence the success of collaborative learning is the students' group formation, which consists in the realization of heterogeneous groups in terms of cognitive resources, characteristics, and behaviors, composed by four or five students. However, the correct implementation of groups requires careful profiling of each student's behavior which can be difficult for the teacher to detect. In this work an intelligent software, developed using Artificial Intelligence algorithms, was used to assist the teacher in the realization of heterogeneous groups of students. It is composed of a Machine Learning model, consisting in clustering techniques applied to Moodle learning analytics performed to return clusters that identifies different students' profiles, and a specific algorithm that automatically organizes the groups, ensuring the heterogeneity including at least one student from each cluster. At the end of the execution the software returns the list of the heterogeneous groups to the teacher. The software was applied to assignments that required working group within a specific online course for university students, using a Moodle e-learning platform. The quantitative analysis demonstrated the effectiveness of the numerical method for group composition proposed in this work to ensure successful collaborative activities, confirmed also by the perceptions of the students on the course.

Keywords: collaborative activities, machine learning, Moodle, e-learning

1. Introduction

Collaborative activities are important and effective teaching methodologies that enable active learning to improve learning outcomes.

Research experiences demonstrate how the use of digital technologies help the realisation of on-line collaborative learning using activities such as gamification (Hasan, 2019), peer assessment (Badea, 2019), collaborative writing (Biasutti, 2017) and led teachers to organise online collaborative activities in a very flexible way using e-learning platforms such as Moodle (Abedin, 2012). Several authors have compared learning outcomes in online courses between students who worked in groups and students who worked individually, demonstrating the effectiveness of collaborative activities (Van Eijl et al, 2005), which lead to an improvement in higher cognitive abilities and excellent results.

However, collaborative online activities do not always improve student performance. Factor that influences the success of collaborative learning is the creation of heterogeneous groups, both in terms of cognitive resources, characteristics, and behaviours (Nijstad et al., 2002), and in the realisation of groups, which tend to be effective if composed of 4-5 members, as confirmed by research evidence (Burke, 2011). Detecting students' behaviour is a fundamental requirement to create heterogeneous courses, but it's not always easy for instructors, in particular when they have to manage a large number of students. (Hieu, L. T. et al, 2021). Due to these difficulties, teachers tend to create random groups, hoping to achieve heterogeneity within the groups (Bacon, 2001) but this approach it's not always effective. In Wiki activities, random groups can reduce their engagement in the topic affecting the achievement of their learning outcomes. (Sun, 2014).

Even though researchers attempted to overcome these limitations by using Artificial Intelligence to automatically create heterogeneous groups using data extracted from students' interactions with Forum (Maina et al., 2017), the need to identify students' behaviour in a specific online course led us to execute an intelligent software using Clustering to create heterogeneous groups applied to Moodle Log data to achieve this goal.

The goal of this project was to create effective heterogeneous groups for collaborative writing activity (Wiki) in order to meet the requirements for obtaining a successful teaching methodology that would benefit university students in terms of learning and soft skills.

This work entails the creation of a collaborative writing activity that allows groups of students to improve the learning experience of students enrolled in the "User Experience (UX) Design" blended course of the Computer Science degree programme, which consisted of an individual and a group project component, which included collaborative writing.

The obtained clusters were used for the group composition, inserting at least one student belonged to different clusters to the same group, guaranteeing heterogeneity.

Before creating the groups, a further verification of the clusters obtained was performed to confirm the similarity of the students within the same cluster and the differences with the members of the other clusters. For this purpose, the types of the students belonging to each cluster were compared with the evaluations obtained by them during an individual task, requested of them in the first phase of the course in order to check if there was a correspondence between cluster type and evaluation score.

The second phase involved analysing the students' perceptions to determine whether there were any benefits in terms of learning and soft skills.

2. Methodological aspects

The course is part of the undergraduate degree in Computer Science and it involves students enrolled to the last year of the degree programme. It was delivered in a blended learning format via the University's Moodle e-learning platform with the participation of 111 international (mainly composed of European, African, Arab, Indian And Asian) students taking part, characterised by 90 men and 21 women.

It aims to guide students to gain an understanding of underpinning theoretical concepts and practical techniques relevant when considering humans, both in the organisation of design and design processes, and as a way of incorporating a user perspective in the design of products and services.

Students' knowledge was assessed firstly across an individual task through multiple choice quiz (used as part of assessment for undergraduate courses in computer science (Roberts, 2006) and then through collaborative writing activity based on the practical work undertaken.

The on-line multiplechoice quiz consisted of 25 questions of 35 minutes duration based on the topics included in the on-line pathway performed in the e-learning platform supervised by the teacher in class.

In the collaborative group coursework, students are tasked to research, design, and evaluate an interactive system using an iterative ‘user-centred design’ approach. Students are expected to contribute equally to their group work.

For group formation, an intelligent software, based on Clustering techniques using K-means algorithm applied to Moodle log data, creates firstly clusters of students with the similar characteristics and then heterogeneous groups distributing students of the same clusters into different groups (Nalli et al. 2021). Moodle log data extracted by the e-learning platform allows for the calculation of various aspects of the student learning process, as well as the identification of students' behaviour using clustering techniques. Specific log data were carefully chosen to create the input dataset for the clustering process.

Research shows that log data extracted from the Moodle platform, properly selected, allow the calculation of different aspects of the student learning process, such as “presence coefficient”, “study coefficient”, and “activity coefficient”, and therefore permit the identification of online user behaviour, using clustering techniques. Different Moodle log data needed are used in this work, consisting of login frequency, last login, total time spent online, number and frequency of video viewed, number and frequency of files opened (Bovo, 2013).

In this work, that was the first step of the research process, the Pre-experimental design was used, where subjects or groups were observed after a treatment had been applied, in order to test whether the treatment had the potential to cause change (Frey, 2018). Because of the pre-experimental design no control group was applied to this work. (Thyer, 2012).

Finally, the course provided an anonymous questionnaire based on past tested similar investigations related to the students’ perception about collaborative activities (Landry et al.,2015) (Amendola et al., 2016). It consisted of 18 questions divided into behaviours, opinions, and comments, characterised by open and closed-ended questions using Likert Scale, related to the online course, in terms of advantages and disadvantages of collaborative activities based on working groups, and improvements of learning outcomes and soft skills.

3. Results

Once the dataset was identified, it was possible to run the software, which used the K-Means algorithm in addition to the Elbow method to generate four clusters.

Each cluster determined identifies different behavioural profiles of students basing on the interaction on the platform.

Table 1: Details of analysed features (average values) for each cluster

	Cluster 0	**Cluster 1**	**Cluster 2**	**Cluster 3**
Students	9	23	26	53
total logins	17,5	14	16	12
total files	3	1,6	1,2	0,9
frequency of files viewed	10,5	4,9	5,1	2,7
total videos	6,7	5,6	5,1	3,4
frequency of videos viewed	1,1	1,3	1,1	1,2

The students in Cluster 3 (53 members) were either inactive or had low interaction levels. This is evident by the low number of accesses to the course, with an average of 12, and low viewing of files (average of 0.9) and videos (average of 3.4).Cluster 2 (26 members) and Cluster 1 (23 members) represents students with average participation on the online course, demonstrating by the higher values compared Cluster 3 in file (average 1,2 and 1,6 respectively) and videos (average 5,6 and 5,1 respectively) viewing and the total access on the course (14 and 16 respectively).Cluster 0 (9 members) instead includes students with high interaction reported by the highest values in terms of access to the course (17,5) files (3) and videos (6,7).

The correspondence with the grade obtained by the students in the individual part of the course confirms the differences between students belonging to different clusters. This correspondence suggests how the level of interaction on the platform had feedback in terms of performance, with cluster 3 that got a very low score equal to 63, Cluster 1 and Cluster 2 that received good scores equal to 71 and 72, and Cluster 0, which represented students with high activity on the platform, achieving an excellent score average equal to 78.

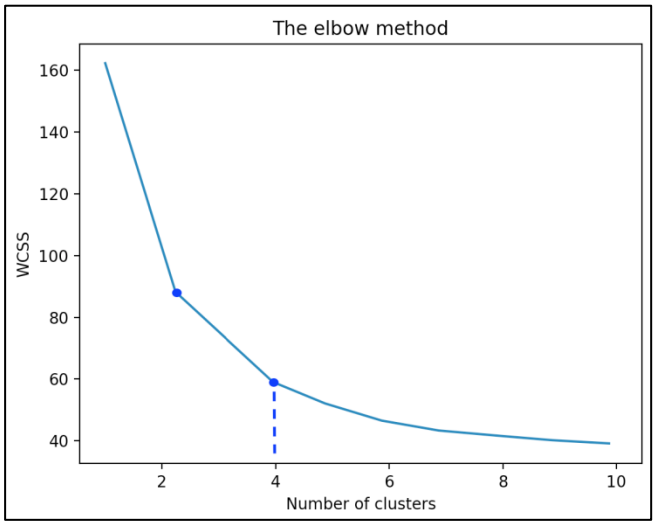

Figure 1: Elbow method plot, that allows to find the appropriate number of clusters for a specific dataset

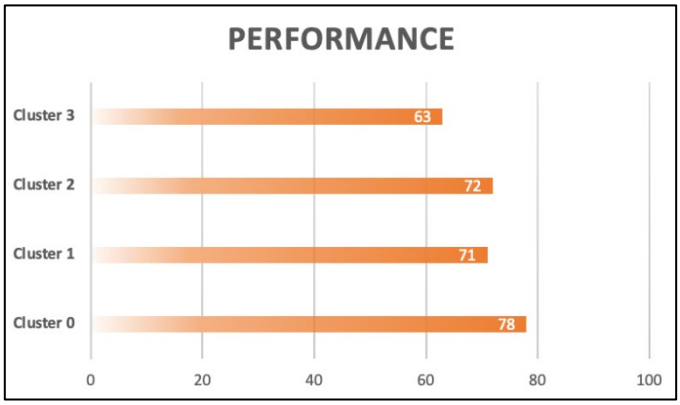

Figure 2: Correspondence between students' activity in the online pathway and individual task evaluation

This verification allows us to identify accurate profiles of homogeneous students for each cluster, ensuring heterogeneity in the building of 20 heterogeneous groups of 4-6 members, which contributes to the success of the collaborative activity. The questionnaire confirms the positive outcomes of the wiki based on heterogeneous groups, with the majority of the students believing that group members' contributions were useful for the collaborative work (78%), and the experience was motivating (75%) and increased their engagement in the study (75%). Table 2 suggests that 73% of students believe it improves learning outcomes, which is supported by open questions.

Table 2: Categories of qualitative answers extracted from the questionnaire with examples of student comment

Question	Skills	Example of positive feedback	% of students
Improvement of learning and knowledge	Teamwork	Working together has definitely helped us gain a lot of knowledge of our subject and also have a better understanding of working together.	35%
	Share information	We got to share our ideas and combine the different ideas that each one of us had.	29%
	Communication	Everyone communicated with each other and when someone didn't know about a specific topic, we would all explain that topic to them	13%
Improvement of soft skills	Communication	They allow us to be able to communicate more efficiently.	51%

Question	Skills	Example of positive feedback	% of students
	Team Work	It allows everyone to feel like a team player and having an idea on how to also give constructive feedback	8%
	Problem-Solving	It influences Problem-solving.	8%
	Time Management	It allows to manage the time efficiently	5%

4. Conclusions

The outcomes demonstrated the success of the online collaborative activity based on heterogeneous groups. The comparison of obtained clusters and grades highlighted the software's effectiveness in creating heterogeneous groups of students, which is critical for assisting students in achieving learning outcomes and developing soft skills. The quantitative and qualitative analysis, which was carried out by processing the data extracted from the final questionnaire completed by the students, revealed excellent feedback in terms of the students' perception and satisfaction, particularly in terms of group members' contributions, motivation, engagement, and improvement of learning outcomes. A future extension of this work could include an analysis of the grades earned by students in collaborative activities to test if the performance reflects the students' perceptions. Once tested the effectiveness of the software, the challenge could be applying the experimental design with a control group.

References

Abedin, B., Daneshgar, F., D'Ambra, J. (2012). "Pattern of non-task interactions in asynchronous computer-supported collaborative learning courses". Interact. Learn. Environ., Vol 22, pp 18–34.

Amendola, D., and Miceli, C. (2016). "Online Physics laboratory for University courses". Journal of E-learning and Knowledge Society, Vol 12.

Bacon, D. R., Stewart, K. A., and Anderson, E. S. (2001). "Methods of Assigning Players to Teams: A Review and Novel Approach", Simulation & Gaming, Vol 32, No. 1, pp 6–17.

Badea, G., Popescu, E., Sterbini, A., and Temperini, M. (2019). "Integrating Enhanced Peer Assessment Features in Moodle Learning Management System",Foundations and Trends in Smart Learning Lecture Notes in Educational Technology Springer.

Biasutti, M. (2017) "A comparative analysis of forums and wikis as tools for online collaborative learning", Computers & Education, Vol 111,pp 158-171.

Bovo, A., Sanchez, S., Heguy, O., Duthen, Y. (2013). "Clustering Moodle Data as a Tool for Profiling Students." Proceedings of the 2013 Second International Conference on E-Learning and E-Technologies in Education (ICEEE), pp 121–126.

Burke, A. S. (2011). "Group Work: How to Use Groups Effectively." The Journal of Effective Teaching, Vol 11, pp 87-95.

Frey, B. (Ed.) (2018). "The SAGE encyclopedia of educational research, measurement, and evaluation." SAGE Publications, Vol. 1-4.

Hasan, H. F., Nat, M., and Vanduhe, V. Z. (2019). "Gamified Collaborative Environment in Moodle",IEEE Access, vol. 7, 89833-89844.

Hieu, L. T., Hương, D. T., Huy, D. T. N., Dung, M. N. T. P., and Trung, N. D. (2021). "Identifying learners' behaviour from videos affects teaching methods of lecturers in Universities", Design Engineering, pp 11146-11157.

Landry, A., Jacobs, S., and Newton, G. (2015). "Effective use of peer assessment in writing assignment: a case study". International Journal of Higher Education, Vol 4, pp 38-51.

Maina, E. M., Oboko, R. O., and Waiganjo, P. W. (2017). "Using machine learning techniques to support group formation in an online collaborative learning environment". International Journal of Intelligent Systems & Applications, 9(3), 26-33.

Nalli, G. , Amendola, D., Perali, A., and Mostarda, L. (2021). "Comparative Analysis of Clustering Algorithms and Moodle Plugin for Creation of Student Heterogeneous Groups in Online University Courses". Applied Science, Vol 11, pp 1-21.

Nijstad, B. A., and De Dreu, C. K. W. (2002). "Creativity and group innovation". Applied Psychology: An International Review, Vol 51, No.3, pp 400–406.

Sun, J. C. Y. (2014). "Influence of polling technologies on student engagement: An analysis of student motivation, academic performance, and brainwave data", Computers & education, Vol 72, pp. 80-89.

Roberts, T. S. (2006). "The use of multiple choice tests for formative and summative assessment." Proceedings of the 8th Australasian Conference on Computing Education, Vol 52, pp 175–180.

Thyer, B. A. (2012). "Quasi-Experimental Research Designs", Oxford University Press.

Van Eijl, P. J., Pilot, A., and De Voogd, P. (2005). "Effects of collaborative and individual learning in a blended learning environment", Education and Information Technologies, Vol 10, No. 1-2, pp 51-65.

Empowering Students to Engage in the Design of COVID-19 Related Gamified Applications

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Abstract: COVID-19 related games have recently been developed to combat misinformation and raise awareness of COVID-19 protocols. COVID-19 related games or gamified apps were designed using top-down approaches (from company to players). The COVID-19 pandemic highlighted challenges in their uptake and usage. Strategies such as co-design may be leveraged to address these challenges, particularly for developing new technologies. This in-progress, exploratory mixed-methods study aimed to engage university students in designing gamified applications to address their needs amidst and post-pandemic. Its first step was to empower students to think of design ideas. The study's research questions were: What are students' goals for designing pandemic-related gamified apps? To what extent do students make use of gamification techniques in their design? A convenience sample of 20 third/fourth-year undergraduates expressed their ideas individually, in an online class, at a time of university closures (May 2021). A second sample of 37 first-year undergraduates engaged in the same activity in a face-to-face class (December 2021). The data were analyzed using a qualitative data analysis software. Thematic analysis was used, data were coded, and themes and sub-themes emerged. Qualitative analysis of all 57 students' responses revealed two main themes expressed by students as a goal for their app: a) increasing pandemic awareness and following hygiene protocols (24/57, 42.1%) and b) building resilience through different ways to cope with the pandemic, including physical exercise, social interaction, entertainment and education (31/57, 54.4%). Students maintained similar design goals for proposed apps despite increasingly less strict public-health measures from May to December 2021. The majority of students (52.6%, 30/57) used one to three gamification techniques, while 38.6% of them (22/57) did not use any. Third/fourth-year students used significantly more (t_{55}=4.65, p=0.000) gamification techniques (M=2.35, SD=1.31) compared to first-year students (M=0.81, SD=1.13). The first stage of this study showed value in involving students in the design of interventions that targeted themselves and revealed the need for training students who lack a design background in identifying relevant gamification techniques. Future research will aim to materialize students' suggested design ideas into design prototypes by involving them in the process through interdisciplinary collaborations.

Keywords: app design, gamification, design for social impact, gamified apps, COVID-19 pandemic

1. Introduction and literature review

COVID-19 related games have recently been developed for a broad audience, not necessarily targeting students. These games aimed to combat misinformation (e.g., GoViral) (Basol et al., 2021) and to raise awareness of COVID-19 protocols or address boredom during the pandemic lockdowns (e.g., Fauci's revenge, Survive COVID) (Balakrishnan, 2020). Recent COVID-19 related games have been designed using top-down approaches without having player voices/needs as the central design feature. The COVID-19 pandemic has highlighted shortcomings of existing technologies and challenges in their uptake and usage. Strategies such as co-design may be leveraged to address these challenges both in adapting existing technologies and developing new technologies (Cosco et al., 2021).

Recent studies showed the value of utilizing student-centered design, a participatory design methodology, in involving students in designing gamified apps that have them as a target audience as a way to address their needs (Nicolaidou et al., 2021; Nicolaidou et al., 2022). A few recent studies involved users in participatory design activities to design gamified apps or educational games (Cheng et al., 2018; Demirbas & Ogut, 2020; Literat et al., 2020). Different approaches were used, primarily based on participatory design workshops. For example, Literat et al. (2020) organized a full-day game design workshop, where 6 participants aged 10-14 brainstormed, developed, and play-tested educational games addressing news literacy (Literat et al., 2020). Cheng et al. (2018) conducted six participatory design workshops, each one of which lasted for 3 hours, with 40 participants aged 16 to 35 years in 3 different cities to identify the best way to present a gamified digital mental health intervention addressed to men (Cheng et al., 2018). These studies showed the potential of participatory game design to encourage and capture users' reflection, discussion, and participation around different topics.

The present in-progress, exploratory study aimed to engage university students in designing gamified applications to address their needs amidst and post-pandemic to examine a) their goals in these designs and b) their use of gamification techniques.

2. Methodology

2.1 Research questions

The research questions of the study were:

- RQ1: What are students' goals for designing pandemic-related gamified apps?
- RQ2: To what extent do students use gamification techniques in their design?

2.2 Sampling, participants, and context of the study

A convenience sample of 57 students in two cohorts (20 third/fourth-year undergraduates and 37 first-year undergraduates) from an EU public university participated in the study. In each cohort, the topic of gamified apps for social change was first introduced through a 3-hour meeting, which took place online at a time of university closures due to the COVID-19 pandemic for the first cohort (May 2021) and in a face-to-face class for the second cohort (December 2021). Students were asked to reflect on the following two questions:

- a) If you could design one gamified app for mobile phones to help people with any aspect of the COVID-19 pandemic, what would that be? Describe its potential goal and its potential users.
- b) Which gamification elements would you incorporate in the design of your app and why?

Students expressed their ideas individually as part of a second meeting that took place online for cohort 1 (n=20) and in a F2F meeting for cohort 2 (n=37).

2.3 Data collection and analysis

Students' responses were anonymized and input into a qualitative data analysis software (NVivo12). Thematic analysis was used, data were coded, and a total of three themes and ten sub-themes emerged. A quantitative data analysis software program (IBM SPSS Statistics 25) was then used to calculate frequencies and percentages and perform an independent-samples t-test analysis.

3. Results

3.1 RQ1 What are students' goals for designing pandemic-related gamified apps?

Qualitative analysis of all 57 students' responses revealed two main themes expressed by students as a goal for their app: a) building resilience through different ways to cope with the pandemic (31/57, 54.4%) and b) increasing pandemic awareness and following hygiene protocols (24/57, 42.1%). As can be seen from Table 1, the majority of students' ideas (31/57, 54.4%) from Cohort 1 (10/20) and Cohort 2 (21/37) fall under the theme of building resilience using different ways to cope with the pandemic, including ways to manage or reduce anxiety, engaging in physical exercise or maintaining social interactions.

Table 1: Students' goals for designing pandemic-related gamified apps

Theme	**Sub-theme**	**Cohort 1** (n=20)	**Cohort 2** (n=37)
1. Building resilience through finding ways to cope with the pandemic	a. Physical exercise or/and social interaction	3	12
	b. Reduce anxiety	4	8
	c. Entertainment	2	0
	d. Education	1	1
2. Increasing pandemic awareness and following hygiene protocols	a. Awareness for COVID19 using quizzes and games	2	1
	b. Informational for covid19 effect (safety app, hygiene practice/protocol)	3	8
	c. Game to defeat COVID or to follow health protocols	2	5

Theme	Sub-theme	Cohort 1 (n=20)	Cohort 2 (n=37)
3. Other	a. Mindfulness/meditation	1	
	b. Helping the elderly	1	
	c. Boost creativity		1

An example excerpt from a student's answer that falls under theme 1. b. (Table 1) is the following:

> *"If I could design one gamified app for mobile phones to help people with any aspect of the COVID-19 pandemic, it would be an application that will help people reduce their anxiety. The application will organize their daily program in order to make their days full and productive. Based on their tasks […], the app will remind them what they must do in their day to succeed in their goals. […] Also, the app will give them ideas on how to spend their days, so they won't feel the anxiety and the boredom that Covid-19 caused". [Student 3, Female, Cohort 1].*

A second central theme focused on increasing pandemic awareness and following hygiene protocols (24/57, 42.1%). An example excerpt that falls under theme 2. b. (Table 1) is the following:

> *"An idea of a Covid-19 pandemic application would be an app reminding people to get their masks before leaving their homes using location tracking technology. […] The app can also get data from google analytics about Covid location outbreaks (reports of the location where a Covid positive person was) to protect other people from going to that location. Also, a good idea would be to have a tab in the app to show credible news about Covid-19 because there is a lot of misinformation and fake news on the internet during these times […]". [Student 10, Male, Cohort 1].*

Students maintained similar design goals for proposed apps despite increasingly less strict public-health measures from May to December 2021.

3.2 RQ2 To what extent do students use gamification techniques in their design?

The majority of students (52.6%, 30/57) used one to three gamification techniques, while 38.6% of them (22/57) did not use any (Table 2). Third/fourth-year students used significantly more (t_{55}=4.65, p=0.000) gamification techniques (M=2.35, SD=1.31) compared to first-year students (M=0.81, SD=1.13) as shown by an independent-samples t-test.

Table 2: Number of gamification techniques used by students in their app design

Number of gamification techniques used	Cohort 1 n=20	Cohort 2 n=37	Total
	N (%)	N (%)	N (%)
0	1 (5%)	21(56.8%)	22(38.6%)
1	5 (25%)	7(18.9%)	12(21.1%)
2	5 (25%)	5(13.5%)	10(17.5%)
3	5 (25%)	3(8.1%)	8(14.0%)
4	3 (15%)	1(2.7%)	4(7.0%)
5	1(5%)	0 (0%)	1(1.8%)

An example of a student's answer in which two gamification techniques are identified (the use of scoring and the use of badges) is provided:

> *"In my application's idea, I would give badges to people for reading the news in the "news" tab and by staying at home protecting themselves. Also, it would be nice to keep a score on the number of times that a user grabbed their masks before they left home. Maybe the app can send popup notifications questioning the user if they are socializing using video calls and give them a "socializing" badge". [Student 10, Male, Cohort 1]*

4. Discussion and future research steps

The first stage of this study showed value in involving students in the design of interventions that targeted themselves and revealed the need for training students who lack a design background in identifying relevant gamification techniques. Future research will aim to materialize students' suggested design ideas into design prototypes by involving them in the process through interdisciplinary collaborations.

References

Balakrishnan, V.S., 2020. COVID-19: Playing away the pandemic. Lancet Infect. Dis. 20, 792. https://doi.org/10.1016/S1473-3099(20)30507-7

Basol, M., Roozenbeek, J., Berriche, M., Uenal, F., McClanahan, W.P., Linden, S. van der, 2021. Towards psychological herd immunity: Cross-cultural evidence for two prebunking interventions against COVID-19 misinformation. Big Data Soc. 8, 20539517211013868. https://doi.org/10.1177/20539517211013868

Cheng, V.W.S., Davenport, T.A., Johnson, D., Vella, K., Mitchell, J., Hickie, I.B., 2018. An App That Incorporates Gamification, Mini-Games, and Social Connection to Improve Men's Mental Health and Well-Being (MindMax): Participatory Design Process. JMIR Ment. Health 5, e11068. https://doi.org/10.2196/11068

Cosco, T.D., Fortuna, K., Wister, A., Riadi, I., Wagner, K., Sixsmith, A., 2021. COVID-19, Social Isolation, and Mental Health Among Older Adults: A Digital Catch-22. J. Med. Internet Res. 23, e21864. https://doi.org/10.2196/21864

Demirbas, D., Ogut, S.T., 2020. Re-Designing the Design Brief as a Digital Learning Tool with Participatory Design Approach. Turk. Online J. Distance Educ. 21, 83–100. https://doi.org/10.17718/tojde.690356

Literat, I., Chang, Y.K., Hsu, S.-Y., 2020. Gamifying fake news: Engaging youth in the participatory design of news literacy games. Convergence 26, 503–516. https://doi.org/10.1177/1354856520925732

Nicolaidou, I., Aristeidis, L., Christodoulou, C., & Lambrinos, L. 2021. Co-creating a gamified app for enhancing students' emotional resilience in times of crisis (COVID-19). INTED2021 Proceedings, 4169–4175. https://library.iated.org/view/NICOLAIDOU2021COC

Nicolaidou, I., Aristeidis, L., & Lambrinos, L. 2022. A gamified app for supporting undergraduate students' mental health: A feasibility and usability study. Digital Health, 8, https://doi.org/10.1177/20552076221109059.

Learning Analytics: A case study of Adaptive Video Activities

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Abstract: Adaptive elements are integrated in activities to facilitate personalization of the learning process and provide learning analytics for each student. Following the digital storytelling trends, integrating adaptive activities in interactive videos facilitates student engagement in crucial topics and personalizes the learning path to each individual student's pace and learning ability. However, it is considered challenging for teachers to design an effective cluster of adaptive activities and to make sense of the learning analytics that are provided. A literature review was conducted to examine how teachers make use of user analytics in real circumstances. It showed that despite the variety of existing tools that can facilitate teachers in collecting learning analytics, the raw data require further analysis for the teacher to be able to understand the students' individual paths and more training is required so that teachers can effectively interpret these data. This paper is based on a case study conducted to examine how learning analytics are used and what tools can support teachers in making sense of their students' data. Moreover, it reveals how students perceive adaptive activities, in relevance to their flow and usability, as part of the overall goal of the activity, which focused on environmental awareness. To understand the processes involved around the implementation of adaptive activities, an interactive video with adaptive activities was designed and implemented in a classroom of 12 students (M=12.5 years old). The methodology followed a quantitative approach. A structured questionnaire was used to understand students' perspectives regarding the flow and usability of the adaptive activities. Considering students' perspectives on the flow of the adaptive-interactive video activity, students' level of absorption and the natural progress of the activities received scores of 3.8/5 and 4/5, respectively. The usability of the activity received an average of 75.4 as a System Usability Score (SUS), which is considered above average. The results reveal that both flow and usability are essential for the effective implementation of adaptive activities. This research study recommends further studies of the topic to understand how learning analytics can become manageable and/or better integrated in software enabling the creation of adaptive activities.

Keywords: learning analytics, data, adaptive activities, flow, usability, digital assessment

1. Introduction and Literature Review

Learning analytics is an emerging field that focuses on analyzing learners' interactions with educational content (Nicolaidou et al., 2019). Following the teaching trends, adaptive elements are integrated in activities to facilitate personalization of the learning process and in this way, teachers are provided with learning analytics, which are specific for each student and indicate their learning state (Peng, Ma, & Spector, 2019). In an experiment carried out in 2013, students taught via an adaptive learning system - where their personal preferences, characteristics and needs were taken into account - had performed significantly better than students taught via a traditional learning system with no learners' personalization options; thus, it can be said that adaptive learning can facilitate the improvement of learners' performance (Yang, Hwang, & Yang, 2013). Kinshuk, et al. (2009) stress the importance of personalized learning through adaptive approaches. Considering the recent teaching trends, increasing students' engagement and scaffolding learning can both be enhanced through interactive digital storytelling techniques (Shelton, Warren, & Archambault, 2016). Thus, the creation of interactive videos that include adaptive activities could increase student performance and engagement in crucial topics as well as personalize the learning path to each individual student's pace and learning ability providing rich analytics for the teacher.

To facilitate the creation of digital adaptive activities, Rozo and Real (2019) created guidelines based on pedagogical models and suggested that the data provided by digital adaptive resources need to become manageable by integrating Artificial Intelligence and learning analytics that would facilitate the process based on pedagogical elements. Similarly, Atkinson (2015) argued that learning analytics are so complicated that they serve the learning providers rather than the teachers and learners using them, and he suggested that for the educational community to be able to benefit from learning analytics, there is a need for the purposeful integration of the pedagogical and andragogical theories of learning into technological solutions.

Despite the fast growth of the field, teachers do not adopt the use of learning analytics mainly due to technical difficulties and the lack of connecting learning analytics with pedagogical theory. Research for the development

of tools and frameworks to facilitate the use of learning analytics by the teachers reveals that the majority of those tools and frameworks are not validated, thus, they are not applicable in practice (Kaliisa, Kluge, & Mørch, 2022).Following this, it is considered particularly challenging to incorporate learning analytics effectively in technologically supported applications for learning (Nicolaidou et al., 2019) and it is considered challenging for teachers to design an effective cluster of adaptive activities and to make sense of the learning analytics that are provided.

The aim of this study is to explore how students perceive adaptive activities integrated in interactive videos based on pedagogical theory in relevance to the adaptive-interactive video activity flow and usability. The study attempts to highlight the importance of creating and implementing such activities in classroom settings and stress their benefits for the students to encourage the better integration of learning analytics into software facilitating their creation.

2. Methodology

2.1 Research question

This paper is based on a case study conducted to examine how students perceive adaptive activities, in relevance to their (a) flow and (b) usability, as part of the overall goal of an environmental awareness activity.

2.2 Sampling, participants, and context of the study

To understand the processes involved around the implementation of adaptive activities, an interactive video with adaptive activities was designed. Firstly, two videos of three different scenes were created to enable the personalization of the learning path for each student. One of the videos was simple and did not contain any scaffolding, while the other was enhanced with subtitles and other supporting elements to facilitate the learners' understanding of its meaning. Then, using the interactive video platform PlayPosit, the two videos were combined using interactive activities and assessment scores. The enhanced video was only available to students who struggled to find 60% of the correct answers. The students were directly forwarded to this video based on their success score. Students with a score over 60 % kept on watching the video without any supporting information. Learning analytics were provided by the same platform after the students used the video and answered embedded questions.

The interactive video activity was implemented in a classroom of 12 students (M=12.5 years old) (convenience sampling). The implementation took place in a computer lab equipped with a laptop and projector for the teacher as well as a personal computer for each student. The initial, introductory whole-class activity involved projecting a video about people's relationship with the natural world as a way to start an environmental discussion. Then, the teacher (first author of the study) made some video-specific questions and asked the students to access the interactive video activity on their computers to practice at their own pace. The students were focused on the video trying to answer the questions. The teacher's role was limited to facilitating the process.

2.3 Data collection and analysis

The methodology followed a quantitative approach. A structured questionnaire was used to understand students' perspectives regarding the flow and usability of the adaptive activities integrated in the interactive video (RQ). This questionnaire was given to the students to complete online after their use of the interactive-adaptive video activity. It consisted of 10 questions to measure Flow (FKS questionnaire) by Rheinberg, Vollmeyer and Engeser (2003) and 10 questions to measure usability of the activity (System Usability Scale SUS) (Bangor et al., 2008). All questions were measured on a 1 to 5 Likert scale from 1=Completely disagree to 5=Completely agree.

3. Results

3.1 How do students perceive adaptive activities, in relevance to their (a) flow and (b) usability, as part of the overall goal of an environmental awareness activity?

Measuring students' perspectives on flow using the FKS questionnaire (Rheinberg et al., 2003), Figure 1 shows the level in which the students were absorbed (Q1, Q3, Q6, Q10) in the interactive video activity on a scale 1 to 5. Students rated their level of concentration in the activity with average scores ranging from M=3.7 (SD=1.3) to M=4.1 (SD=1.1) out of 5. The overall absorption level score was M=3.83 (SD=1.2).

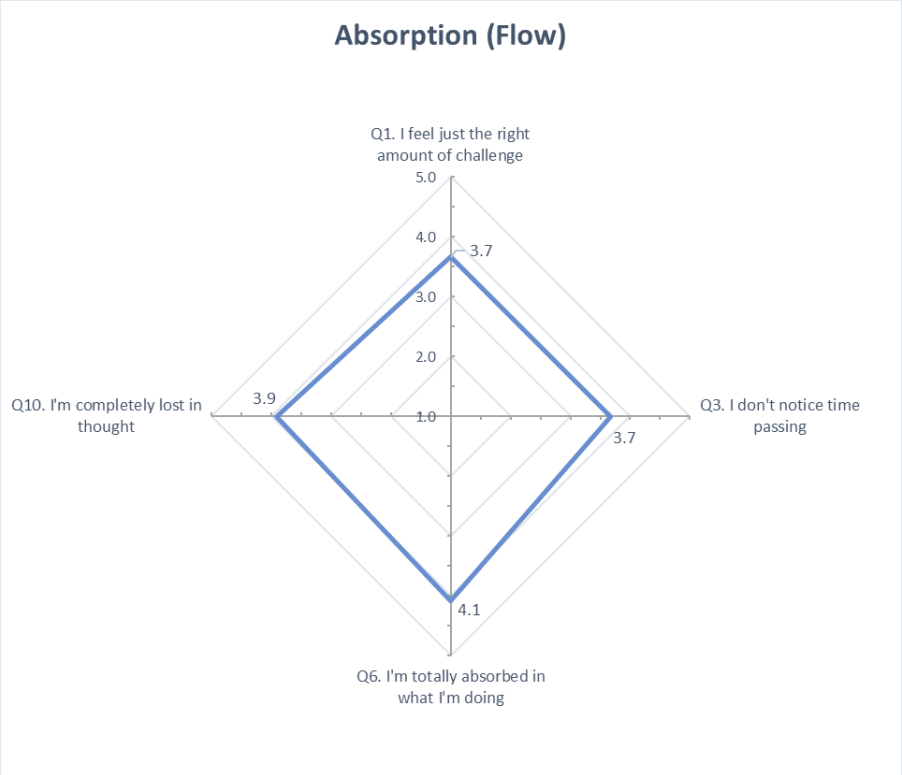

Figure 1: Students' level of absorption in the interactive video activity

Considering students' answers regarding the natural progress of the interactive video activity, Figure 2 reveals that students feel like the activity runs smoothly (Q2: M=4.2, SD=0.7), they have everything under control (Q9: M=4.2, SD=0.8), they know what comes after each adaptive activity (Q8: M=4.2, SD=1.0) and they have a clear mind during the activity (Q5: M=4.1, SD=1.0). The items receiving a score below 4 refer to the students' level of concentration (Q4: M=3.8, SD=1.3) and the natural occurrence of students' right thoughts (Q7: M=3.7, SD=1.1). The overall score for the factor of natural progress is M=4.01 out of 5 (SD=1.0).

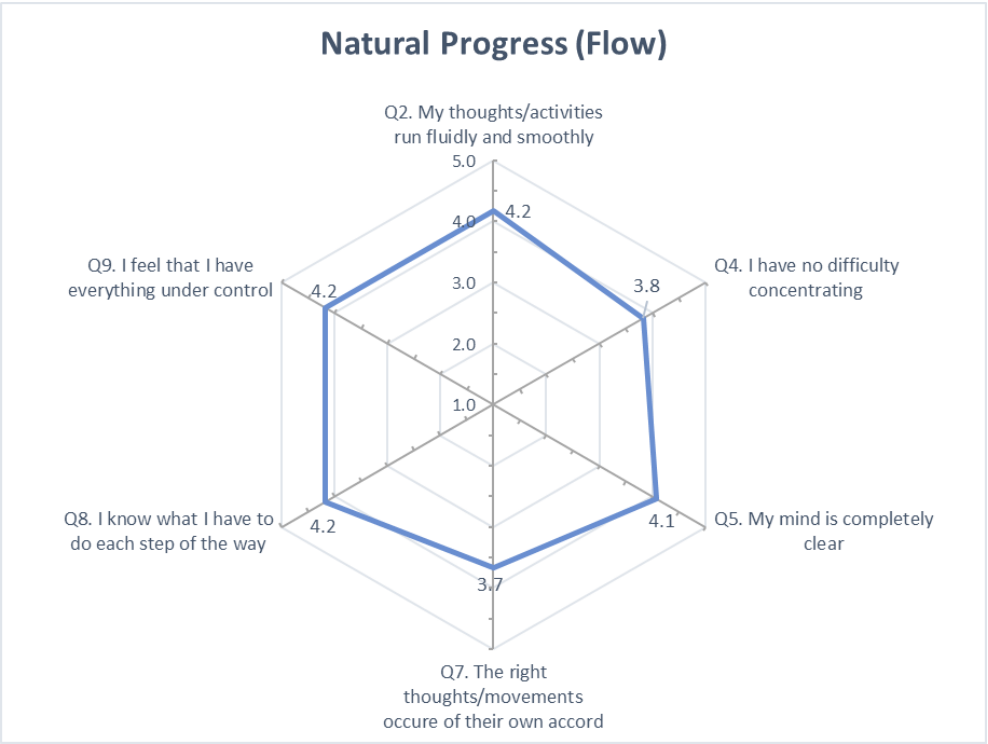

Figure 2: Students' natural progress level in the interactive video activity

The usability of the interactive video activity received an average of 75.4 as a System Usability Score (SUS). Considering that the general average SUS score is 68, Figure 3 indicates that 8 out of 12 participants in the study have rated the interactive activity with scores above average.

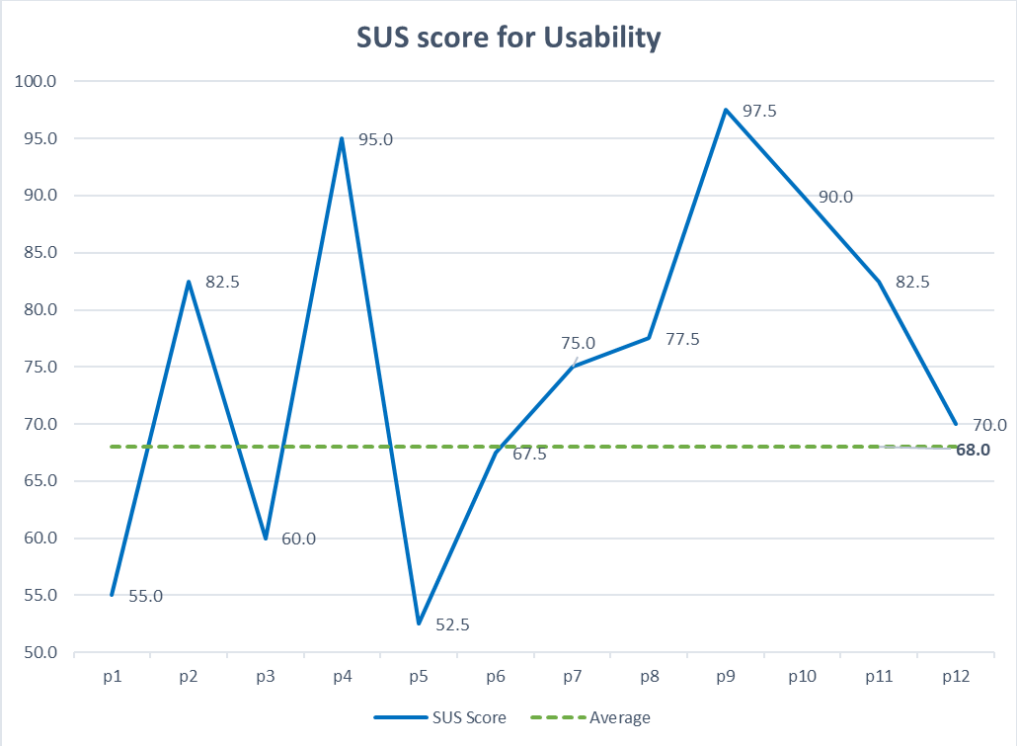

Figure 3: SUS score graph for the interactive video activity

4. Discussion and future research steps

There is a gap between learning analytics and teaching practice thus not much research exists on the effective use of learning analytics by teachers particularly in the context of adaptive video activities. Adaptive activities show great potential for personalizing instruction, yet how the data they produce can be used in real time for the benefit of instruction remains to be seen. The results reveal that both flow and usability are essential for the effective implementation of adaptive activities. This research study recommends further studies of the topic to understand how learning analytics can become manageable and/or better integrated in software enabling the creation of adaptive activities.

References

Atkinson, S. P. (2015) Adaptive Learning and Learning Analytics: a new learning design paradigm. *BPP Working Paper*, *January*, 1–9.

Bangor, A., Kortum, P. T., and Miller, J. T. (2008) 'An empirical evaluation of the system usability scale' *Intl. Journal of Human–Computer Interaction, 24*(6), 574-594.

Kinshuk, Chang, M., Graf, S., and Yang, G. (2009) 'Adaptivity and Personalization in Life-Long Learning', *Designing Adaptive and Personalized Learning Environments, 8*(2), 27–36. https://doi.org/10.4324/9781315795492-7

Kaliisa, R., Kluge, A., and Mørch, A. I. (2022) 'Overcoming Challenges to the Adoption of Learning Analytics at the Practitioner Level: A Critical Analysis of 18 Learning Analytics Frameworks', Scandinavian *Journal of Educational Research, 66*(3), 367–381. https://doi.org/10.1080/00313831.2020.1869082

Nicolaidou, I., Tozzi, F., Kindynis, P., Panayiotou, M., and Antoniades, A. (2019) 'Development and usability of a gamified app to help children manage stress: an evaluation study', *Italian Journal of Educational Technology, 27*(2), 105-120. https://doi.org/10.17471/2499-4324/1050

Peng, H., Ma, S. & Spector, J.M. (2019) 'Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment', *Smart Learn. Environ. 6*, 9. https://doi.org/10.1186/s40561-019-0089-y

Rheinberg, F., Vollmeyer, R., and Engeser, S. (2003) 'Die Erfassung des Flow-Erlebens' [The Assessment of Flow Experience]. In J. Stiensmeier-Pelster, & F. Rheinberg (Eds.), *Diagnostik von Selbstkonzept, Lernmotivation und Selbstregulation* [Diagnosis of Motivation and Self-Concept]. Göttingen: Hogrefe

Rozo, H. & Real, M. (2019) 'Pedagogical guidelines for the creation of adaptive digital educational resources: A review of the literature', *Journal of Technology and Science Education, 9*(3), 308-325. https://doi.org/10.3926/jotse.652

Shelton, C.C., Warren, A.E. and Archambault, L.M. (2016) 'Exploring the Use of Interactive Digital Storytelling Video: Promoting Student Engagement and Learning in a University Hybrid Course', *TechTrends 60*, 465–474. https://doi.org/10.1007/s11528-016-0082-z

Yang, T.-C., Hwang, G.-J., and Yang, S., J.-H. (2013) 'Development of an Adaptive Learning System with Multiple Perspectives based on Students' Learning Styles and Cognitive Styles' *Journal of Educational Technology & Society, 16*(4), 185-200. http://www.jstor.org/stable/jeductechsoci.16.4.185

Post- COVID-19 Pandemic Education: The Student Perspective

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Abstract: The COVID-19 pandemic can be considered to be a long-term crisis and the outcome of such a crisis is depending on the decisions made during the crisis. As a Higher Education Institution, we are now at a crossroad regarding how to utilize experiences learned during the pandemic. Before the COVID-19 pandemic, there were only a few online study programmes at the Inland Norway University of Applied Sciences, Rena, Norway. During the pandemic, all of the education provided was online. There are now discussions amongst faculty staff regarding a return to the "ordinary" physical lectures or to embark on a hybrid way of educating students. However, equally important is what the students' perceptions of hybrid versus physical lectures are. We have therefor, through qualitative interviews, investigated what would suit the students' needs. We have asked the students if they prefer digital teaching, physical teaching or a hybrid which combines both digital and physical teaching. In this paper we present the results from these investigations. The students feedback indicated clearly that they prefer physical teaching, but also that they would like to have access to digital recordings and lectures. We believe that his feedback is an important input to the further discussions on the New Normal in Higher Education Institutions.

Keywords: hybrid lecture, collaboration, blended learning, synchronous versus asynchronous communication

1. Introduction

The COVID-19 pandemic turned out to last longer than anyone had anticipated at least in the beginning. For some, it has been nearly 2 years with distance education. For some, this has not been a problem, for others it has resulted in psychological problems due to, for instance, solitude (Lehmann et al., 2021). Reports indicate an increase in loneliness and isolation due to lack of on campus activities, including physical teaching (Chen & Ma, 2020). According to Norwegian health authorities (FHI, 2020) every third student experienced loneliness and every forth student suffered psychosocially during the COVID-19 pandemic.

Online education has been offered for decades at our university, but during the COVID-19-pandemic even the regular study programmes had to be delivered online. Most universities organized for distance education utilizing tools for broadcasting lectures. The Learning Management Systems (LMS) have since long enabled digital handling of for example student assignments and student information. Together with the broadcasting, it provided an opportunity for providers of education to stay in practice, and for students to stay in a study programme (Heldt et al., 2021; Iloh, 2019; Neuwirth et al., 2021).

As the pandemic seemed to come to an end, a demand from some of the students arose regarding continuing online education, particularly with adult students that are part time students and in a work life and with different challenges regarding travelling to campus. As it turned out, the online education not only provided students living at or nearby a campus a possibility to stay in a study programme, but also enable others to study which were either hindered by distance, work situation or family situation.

The discussions amongst faculty staff at the Inland Norway University of Applied Sciences, has been focused around three major directions forward; 1) return to ordinary physical lectures only, 2) organize for a combination of some online and some physical attendance, or 3) organize for hybrid lectures with the possibility of joining per internet or physically. The faculty staff has been divided, hence we sought to investigate what the students would prefer and why.

Hence, our problem statement for this paper is:

What are the students' opinions on the three different types of approaches to our delivery of education, and why?

The paper presents students´ own experiences and perspectives which teaching methods they prefer in teaching.

The paper will in the following present the theoretical foundation that has enlighten our study. Then we present our methodological approach, before we present and discuss our data. We lastly conclude and point towards further research.

2. Theoretical foundation

We have chosen a sociocultural perspective because views knowledge as constructed in and through interaction with other people (Cole, 2003; Dysthe & Igland, 2001; Säljö & Moen, 2001; Wertsch, 1991,1998). Learning is understood here as something dialogic, where the individual participates in a social context, and negotiates and develops knowledge in relation to others (Hauge, Lund & Vestøl, 2007). Students learn best when they are engaged and active. Research has shown that students must be activated and engaged to achieve the best learning effect. When teachers and students are geographically separated in online teaching, and communicate using digital tools, students can both feel isolated and lonely, as well as experience reduced interaction with lecturers and other students. In connection with the lack of social contact between students and lecturers, a student survey conducted in 2021 as a part of a project regarding digital education during the COVID-19 pandemic, conclude that more than half of the students choose to turn off the camera in synchronous online teaching, while more than half of the students' state that they learn less when they turn off the camera (Madsbu et al., 2021). Students turn off the camera because they are afraid of or do not want to be challenged by the lecturer, or because they do not want to be seen by others. Such uncertainty and insecurity among students can, however, simply be about not knowing their fellow students or lecturers, or unresolved expectations in synchronous meetings with, for example, Zoom (Madsbu et al., 2021).

Teaching design for online teaching includes everything from full online teaching, via asynchronous, hybrid or blended teaching design, to different uses of combinations of synchronous and asynchronous communication.

Communication can be divided into two categories: synchronous and asynchronous communication (Wagner, Hassanein, & Head, 2008). These ways of communicating will lead to different types of interaction in online teaching. Examples of synchronous communication are chat rooms, seminars and meetings via video conferencing in real time (Shi & Morrow, 2006), while examples of asynchronous communication are digital recording and communication via email.

We will in the following present different learning strategies that includes aspects of online or digital education; blended learning and “flipped classroom”. Blended learning and “flipped classroom” include online activities which may be useful in an online educational setting, such as recorded lessons. In addition, we will point to socio-cultural learning theory as the online environment puts some constraints regarding socializing and learning from each other.

2.1 Blended learning

Blended learning refers to several ways of combining teaching (Deschacht & Goeman, 2015, p.83). Blended learning is a type of learning that integrates traditional face-to-face teaching with online activities. It turns out that many colleges have developed their own course packages that are based solely on online teaching, both with a small degree of face-to-face interaction between students and lecturers or between students. The interaction in online teaching can be synchronous or asynchronous. Video conferencing, as a digital tool, represents a range of possibilities in its ability to enable interaction between lecturer and students (Offir & Lev, 1999). Several studies show that the communication and interaction in online teaching is characterized by little interaction between the participants in the online teaching (McBrien, Cheng, & Jones, 2009). Teaching with the use of video recording turns out to contribute to increased student satisfaction because it helps students' overall learning and improves comprehension. Other studies of digital recordings have shown little or no positive impact on student performance (Bos, Groeneveld, Van Bruggen, & Brand - Gruwel, 2016; Franklin et.al., 2011; Leadbeater, Shuttleworth, Couperthwaite & Nightingale, 2013; Marchand, Pearson & Albon, 2014; Yoon & Sneddon, 2011). According to Salmon (2004), lecturers must provide students with training in the digital tools to be used in teaching before teaching begins.

2.2 Flipped classroom

Flipped classroom is a pedagogical model for learning where traditional teaching is "turned around", in that students are given access to digital recordings of lectures, which they can watch at home, and then the time at

the educational institution is used to work with the subject matter with lecturers and fellow students. Gotaas (2016, p.191) refers to flipped classroom, as reverse teaching. According to Krokan (2012, p. 157), the use of a flipped classroom can promote opinion testing and opinion formation, which in turn can help to improve the learning outcome (Krokan, 2012, p. 157). Flipped classroom is also a teaching design that has developed in parallel with the digital development. This teaching design calls for more student-centered teaching (Låg & Sæle, 2019). In the flipped classroom, pedagogy is student-active learning activities, such as seminars, presentations and various forms of group work (Government, 2013).

2.3 Socio-cultural learning theory

There are different perceptions about how learning should be defined, what characterizes learning and how learning takes place (Havnes & Prøitz, 2016; Shepard, 2000; Bråten, 2002). The socio-cultural perspective on learning emphasize that learning takes place both individually and through social interaction. Perspectives include the importance of participation, dialogue, and interaction (Shepard, 2000; Bråten, 2002). A sociocultural perspective views knowledge as constructed in and through interaction with other people (Cole, 2003; Dysthe & Igland, 2001; Säljö & Moen, 2001; Wertsch, 1991, 1998). Learning is here understood as something dialogical, where the individual participates in a social context, and negotiates and develops knowledge in relation to others (Hauge, Lund & Vestøl, 2007).

The use of synchronous communication online are good examples within a socio-cultural perspective, which shows the importance of student-active learning with reflection, interaction, dialogue and sharing of knowledge. From a socio-cultural perspective, the use of a video conference in synchronous meetings can be described as a cultural tool, because it opens opportunities for interaction, reflections and exchange of views and perspectives. (Kvåle & Rambø, 2015; Luehmann & Tinelli, 2008). Digital recording and asynchronous communication, on the other hand, do not open the same possibilities as the use of video conferencing systems in synchronous meetings does in teaching. The socio-cultural perspective emphasizes that learning takes place best when people interact and communicate together in a context based on community and physical proximity (Dysthe, 1999). Language makes it possible to share experiences, thoughts, and perspectives. Language as a tool is basically the mainstay that enables interaction. Social interaction and dialogue with others mean that you learn to use language as a tool. The interaction processes include both interaction between people who are to learn, and interaction between people and tools (Igland & Dysthe, 2001). In a socio-cultural perspective, therefore, the context is decisive for what is learned and how it is learned (Säljö, 2015, p.15). According to Bateson (1973), all communication presupposes a context to be comprehensible. All actions and all communication are situated and must therefore be understood within the framework of the activity they are part of. In a socio-cultural perspective, learning and development are understood as a context-dependent, social phenomenon (Säljö, 2013,2015, p.135). In a socio-cultural perspective, learning and teaching are seen as something that takes place in interaction with others, as part of a social activity. The socio-cultural perspective forms the basis for a dialogical form of teaching, where views and perspectives are shared between the parties. Dysthe (2013) argues that dialogue is a prerequisite for learning.

2.4 Recording lectures

Previous studies have shown that students' perceptions of the use of recording as a digital tool are seen as something positive, and they want more access to recording (Franklin et al., 2011). Dona et al. (2017); and Morris et al. (2019) found in their studies that the lecturers feared reduced attendance in the lectures and were unsure of the value of admission. However, other studies have concluded that admission may contribute to reduced attendance at the lecture (Bos, Groeneveld, Van Bruggen, & Brand - Gruwel, 2016; Edwards & Clinton, 2019; Holbrook & Dupont, 2009; Morris et al., 2019; Traphagan, Kucsera, & Kishi, 2010).

Digital recordings allow students to study when it is most convenient for them. It is believed that a digital recording enables students to learn better by allowing students to control the speed by listening to a recording (Dey, Burn, & Gerdes, 2009). A digital recording allows students to pause the recording, rewind, and reflect as they go through the content. Students therefore consider digital recordings as positive and as a valuable resource in learning (Toppin, 2011). A digital recording gives a feeling of knowing the lecturer (Hughes, 2009). Reisetter and Boris (2004) have stated how surprised they are at how well students feel they know the lecturers, for example in an interaction between lecturers in a digital recording that has been read in, and how grateful the students are for the efforts of the lecturers and a digital recording. Another advantage of digital recording is

that it provides an extra learning alternative for students instead of just reading academic content, which can help increase motivation (Choi & Johnson, 2005). A digital recording is always available, and they can be reused over several semesters (Allen, Bourhis, Burrell & Mabry, 2002). Several studies therefore show that many students are positive about digital admissions and that they want more of it. Admission can be a well-suited tool for self-study, preparation and rehearsal for exams. Furthermore, admission is a good substitute when students do not have the opportunity to attend the lecture (Bassili & Joordens, 2008; Copley, 2007; Morris et al., 2019).

A study conducted by Johansson and Nohr (2014) concluded that many students want more use of digital recordings, but then in combination with traditional teaching. Nevertheless, many lecturers are ambivalent and sceptical about the use of digital recordings, perhaps because, as previously mentioned, they assume that recordings can mean that students drop the physical lectures, and that there is thus a reduced academic socialization for the students (Maynor, Barrickman, Stamatakis, & Elliott, 2013). However, several international studies show that students do not drop physical lectures even if they have access to admission (Davis et al., 2009; Kushnir, Berry, Wyman, & Salajan, 2011; Lonn & Teasley, 2009). This is also something Fossland (2015) concludes by referring to a survey conducted at the University of Oslo, where as many as 77% of students state that they would not have missed a lecture even if they had had digital recordings available, and 56 % of students used digital recordings to gain a better understanding of the subject matter.

A review article by O'Callaghan et al. (2017) shows that there are several advantages to using admissions in teaching. No adverse effects of the use of recordings have been identified. Students view admission as positive for learning outcomes. This is not supported by the empirical findings of Edwards and Clinton (2019), who conclude that relying on excessive use of lecture recordings can be a pitfall and cannot replace attendance at campus lectures. Marchand et al. (2014) find that a recording combined with physical face-to-face meetings with a lecturer has a greater effect and impact on students' learning than traditional teaching.

Evaluations of the effect of the use of recording lectures in teaching have been limited (Nordmann & Mc George, 2018). Lecturers seem to be unsure of the role of admission in teaching. The students 'physical attendance in the lectures, the interaction that takes place, as well as the students' involvement, are important aspects of the teaching, and the lecturers fear that admission will eliminate these important aspects of the teaching (MacKay, 2019). Research on the use of digital recordings in lectures in higher education has focused on the use and effect of digital recordings (Witton, 2017). Teaching with the use of admission contributes to increased student satisfaction because it has a positive effect on students 'overall learning, and thus improves students' understanding. In addition, students value the flexibility of admission, in that admissions are always available (Franklin et al., 2011). Admission can thus lead to a more active learning in students, as well as it can improve student performance (Baepler, Walker, & Driessen, 2014), although it does not always lead to more satisfied students (Missildine, Fountain, Summers, & Gosselin, 2013).

However, other studies of digital recordings have shown little or no positive impact on student performance (Bos et al., 2016; Franklin et al., 2011; Leadbeater, Shuttleworth, Couperthwaite & Nightingale, 2013; Marchand et al., 2014; Yoon & Sneddon, 2011). According to Skylar (2009), a streamed recording of teaching can mean that communication and collaboration are not limited to a specific time or day. In real-time meetings, on the other hand, the leader lectures the teaching, and the students connect at the same time and can communicate directly with each other.

3. Method of inquiry

For this research we have chosen a qualitative approach (Creswell, 2007; Patton, 2002) where we have interviewed students. In this paper a strategic selection has been chosen (Creswell, 2007), which imply that the chosen informants have the qualifications and properties that are strategically relevant in view of the theoretical perspectives, terms and problem statement as they are adult students and attend seminar based education.

We have interviewed 16 informants. All the informants are students at the Inland Norway University of Applied Sciences, Norway, and they have all been a subject to digital (online) education during the COVID-19 pandemic from March 2020. These were chosen as we assumed, they would provide us with relevant information about their perspectives and perceptions about the experience of participating in digital education. The goal has not been to obtain a representative selection in statistically, but to choose informants strategically in order to obtain

relevant and trustworthy descriptions of the phenomenon (Johannessen et al., 2010). We are thus seeking to obtain information richness and variation regarding digital lecturing during the corona period.

We used a semi-structured interview guide in order to be able to follow up on interesting replies from the students. We then invited the informants by email to a physical meeting. Every interview lasted approximately one hour. Some interviews were done by two researchers where one took notes and the other handled the conversation. These interviews were transcribed by the researchers. Some interviews were done by one of the researchers alone and thus using a tape recorder in order not to miss out on information. These interviews were transcribed by an external transcriber. All interviews were analysed by all three researchers.

According to Postholm (2010) it will support gathering information to establish trust with the informants. We thus sent the informants information about the research, the different steps in the research, and asked them to sign an informed consent form and informed them about how their input would be confidential and their names would be anonymous.

Table 1: Overview of respondents - interviews

Study program	Number of resp.	Gender	
Music Management	1	M	
Digitization and management	1	M	
Organization, leadership and management (online) OLM	3	1.M 2. F	3 of these were also students in the HM module
Health management (HM)	4	1.M 3.F	3 of these were also students at OLM
Knowledge Management (KM)	6	1 M 5 F	

As the table (table 1) display, the respondents were chosen from five different study programmes; Music Management, Digitization and management, Organization, leadership and management, Health management, and Knowledge management.

4. Results and discussion

Here we will present and discuss the results from the data collection.

4.1 Preferred form of lecturing regarding learning outcome

The students were asked to about what the students would prefer; would they prefer to attend physical lectures, or would they rather stay at home and receive the lecture via zoom, and what they believe will provide them with the best learning outcomes. Our observations were as follows: At the Master Programme in Organization and Management there are approximately 100 students, and only a few of the students were actively participating with their cameras on. At the Health Management study programme, a part of the programme is about learning practical management skills in groups. During COVID-19 a hybrid version was offered the students with a combination of the opportunity to meet in person, as well as taking part via Zoom. At the Digitization and management, the Organization, leadership and management study programmes, many students turned off the camera and disappeared when breakout rooms were organized (group work). At the KM study programme, quite a few had their cameras on and participated actively when group work was organized. Hence, there are differences regarding participating and being active. Our experiences as well as socio-cultural learning theory confirm that cooperation and collaboration support an enhanced learning outcome. Also, supported by Dewey (1938) and Schön (1987) being active allows building one's own experiences as well as supporting reflections, something that will support the learning outcome.

Some prefer physical attendance at campus. Statements like "I prefer physical lecturing as it is easier to be active and speak when we meet in the classroom", "Digital lecturing is terrible as we do not see each other's body language and everyone has black screens during lectures", "It is 100% monologue and one way communication on zoom. Zero contact with the lecturers and only black screens" describe some of the frustrations that the students experience with online education.

Recordings, however, are welcomed; "we would like the lecturers to use recordings of the lectures as a supplement to physical lecturing". This is supported in a study by Johansson and Nohr (2014) where they

concluded that students want increased use of digital recordings, but in combination with traditional teaching, not as a substitute. Many lecturers are sceptical regarding using recordings of lectures as they believe students will prefer looking at the recording rather than attending the physical classes. However, several international studies show that students do not drop physical lectures even if they have access to recordings of lectures (Davis et al., 2009; Kushnir, Berry, Wyman, & Salajan, 2011; Lonn & Teasley, 2009).

Several of the students in our investigations claim that it is more difficult to be "on" and focused digitally than it is in the classroom. Some students claim this is due to disturbances either at home or "at work".

One group that seems to divert from the rest of the students, are the students at the KM study programme. Although they are unanimous regarding best learning outcome from physical attendance, they still seem more appreciative of the online alternative. "I could not have attended this study programme if it was not offered online", "my work situation does not allow me to travel, but when it is online, I can attend", and "my family situation prevents me from travelling far from my home and the alternative of online classes has provided me with the opportunity of studying in spite of my situation" are all quotes from this student group. We have no substantial explanation as to why these students differ from the others. We do wish, however, that we had more demographic data for all our respondents.

Socio-cultural learning in the physical versus digital classroom

The students that take part online and do not "disappear" when groupwork is being facilitated, do experience a learning outcome. Statements like "I learn even more about the topic when we work in groups and are able to discuss the different approaches amongst each-other", "I learn a lot from my fellow students when we discuss, and I get a clearer picture of what the issues mean to me" and "I would like the lecturer to organize more groupwork as I learn a lot from that as well as getting to know my classmates a little bit better" confirm what one wants to achieve through the groupwork; socializing, learning and establishing professional relationships amongst the students. These are also examples of how important participation, dialogue, and interaction is to the learning outcome (Shepard, 2000; Bråten, 2002). These respondents seem to be able to construct knowledge in and through interaction with other people (Dysthe & Igland, 2001; Säljö & Moen, 2001; Wertsch, 1991, 1998). The learning seems dialogical, as the individuals participate in a social context, and negotiate and develop knowledge in relation with others (Hauge, Lund & Vestøl, 2007).

4.2 "Flipped classroom" and online education

During the pandemic, there were different types of supporting material that were made available, hence an approach that is closer to a "flipped classroom"- approach. There are, however, students that still do not participate in class. Upon asking them, they say that they are afraid that they have nothing to contribute with. Statements like : "I did not want to sit there as the only one that had not read the curriculum and could not contribute to the discussion", "I knew I would feel stupid and as a "free rider" if I took part in the breakout room as I had not understood the topic we were to discuss", and "I am not so good at expressing myself online and I do not dare take the word unless someone asks me directly" show that there are students that are reluctant to contribute for different reasons. The "flipped classroom" methodology more or less require that the students read up, and study provided material in beforehand and that most of the lectures are groupwork and discussions Gotaas (2016), and although this is supposed to be a student-centred approach (Låg & Sæle, 2019) it may not work in this way always, when it comes to online education.

The statements point to a very important issue: the students need more empowerment and encouragement regarding taking part in online education. In the physical classroom it is more difficult to "escape" and you are drawn into a conversation, but online it is easier to slip away.

Regarding the students that are active and do participate, some claim that there is a "delay" in the communication as it takes time to unmute. This "delay" is perceived as somewhat disturbing and makes the communication less spontaneous. "I could not find the button at once and before I pressed the button, someone else had started talking" and "There was a pause, almost awkward, before someone answered, and it was due to finding and hitting the unmute-button" are statements that show us how it is perceived with the students. The delays disrupt a *flow* in the conversation (Csikszentmihalyi, M 1990). How much this affects the learning

outcome of the discussions are difficult to answer, but we know that perceived *flow* supports the learning process.

5. Conclusion

The students differ regarding hybrid (combination of online and campus education) versus physical education. The ones that are positive towards the hybridity claim that they would be present in person if they could, but sometimes struggle regarding attendance due to for example work or family conditions. They claim that the combination of online and campus based has allowed them to continue studying. Even if an online setting does not provide the optimal learning outcome, they are grateful for being able to participate at all.

Other students much rather only have physical attendance. They claim to learn most from being in the classroom in person and that it is easier to work in groups and to socialise and that this contributes positively to their learning outcomes. This is in line with the socio-cultural learning theories as these confirm the enhanced learning from socializing with fellow students, reflecting and working together with fellow students on f. ex. assignments.

They experienced less cooperation and collaboration with the other students and felt less activated and even alienated if they were not able to read up prior to the online lectures as "flipped classroom" requires.

The students were satisfied with what the lectures made available online, hence the blended learning seemed to work well.

A weakness with our investigations were that we could have collected more demographic data about our students. This would allow us to determine if there were any differences in gender, age and geographical distribution.

5.1 Further research

At our university the decision is to return to face-to-face education, with some exceptions, such as the KM study programme. This study programme will continue being hybrid, whilst most of the other study programmes will be using "flipped classroom" and Blended learning, but only have face-to-face lecturing.

We will investigate if new insights into socio-cultural learning theory may suggest new ways of reducing the technological obstacles that our respondents have reported on. In other words, we will look for other supporting ways of including the online students better and facilitate for collaborative spaces, to see if we can better support the learning outcome both for the students in the classroom as well as the students online.

References

Allen, M., Bourhis, J., Burrell, N., & Mabry, E. (2002). Comparing student satisfaction with distance education to traditional classrooms in higher education: A meta-analysis. The American Journal of Distance Education, 16(2), 83–97.

Bateson, G. (1973). Steps to an ecology of mind. London: Paladin.

Baepler, P., Walker, J. D., & Driessen, M. (2014). It's not about seat time: Blending, flipping, and efficiency in active learning classrooms. Computers & Education, 78, 227–236.

Bassili, J. N., & Joordens, S. (2008). Media player tool use, satisfaction with online lectures and examination performance. International Journal of E-Learning & Distance Education/Revue internationale du e-learning et la formation à distance, 22(2).

Bos, N., Groeneveld, C., Van Bruggen, J., & Brand-Gruwel, S. (2016). The use of recorded lectures in education and the impact on lecture attendance and exam performance. British Journal of Educational Technology, 47(5), 906–917.

Copley, J. (2007). Audio and video podcasts of lectures for campus-based students: production and evaluation of student use. Innovations in education and teaching international, 44(4), 387–399.

Chen, J., & Ma, J. (n.d.). Lessons for Online Learning During the COVID-19 Pandemic Period. The CICET 2020 Technical Program Includes 2 Invited Speakers and 19 Oral Presentations. We Are Beholden to All of the Authors and Speakers for Their Contributions to CICET 2020. On Behalf of the Program Committee, We Would like to Welcome the Delegates An, 68.

Creswell, J. W. (2007). Qualitative inquiry & research design : choosing among five approaches (2nd ed.). Sage.

Davis, S., Connolly, A., & Linfield, E. (2009). Lecture capture: making the most of face-to-face learning. engineering education, 4(2), 4–13.

Dewey, J. (1938). Experience & education. Kappa Delta Pi/Touchstone.

Edwards, M. R., & Clinton, M. E. (2019). A study exploring the impact of lecture capture availability and lecture capture usage on student attendance and attainment. Higher Education, 77(3), 403–421.

Fossland, T. (undated). Digital forms of learning in higher education. 2015. University Press, Oslo.
FHI (Public Health Institute). (2020). Quality of life and mental health during the corona pandemic November-December 2020. Retrieved from https://www.fhi.no/div/helseundersokelser/fylkeshelseundersokelser/livskvalitet-og-psykisk-helse-under-koronaepidemien--nov-dec-2020/
Franklin, D. S., Gibson, J. W., Samuel, J. C., Teeter, W. A., & Clarkson, C. W. (2011). Use of lecture recordings in medical education. Medical Science Educator, 21(1), 21–28.
The government. (2013). Time for the MOOC MOOC committee's interim report. Obtained from https://www.regjeringen.no/globalassets/upload/kd/velegg/uh/styrer_rad_utvalg/moocutvalget_delrapport_1_13122013.pdf
Heldt, J. P., Agrawal, A., Loeb, R., Richards, M. C., Castillo, E. G., & DeBonis, K. (2021). We're not sure we like it but we still want more: trainee and faculty perceptions of remote learning during the COVID-19 pandemic. Academic Psychiatry, 45(5), 598–602.
Hughes, G. D. (2009). Using Videos to Bring Lecture to the Online Classroom. College quarterly, 12(1), n1.
Igland, M.-A., & Dysthe, O. (2001). Mikhail Bakhtin and sociocultural theory. Dialogue, interaction and learning. Copenhagen: Klim.
Iloh, C. (2019). Does distance education go the distance for adult learners? Evidence from a qualitative study at an American community college. Journal of Adult and Continuing Education, 25(2), 217–233.
Johannessen, A., Tufte, P. A., & Christoffersen, L. (2010). Introduction to Social Science Methods (Translate from Norwegian: Introduksjon til samfunnsvitenskapelig metode) (Vol. 4). Abstrakt Oslo.
Johansson, M., & Nohr, M. (2014). How does students experience videos produced by the teachers as a learning resource? (Translated from Norwegian:Hvordan opplever studenter lærerens egenproduserte video som læringsressurs?". Høgskolen i Oslo og Akershus.
Kushnir, L. P., Berry, K., Wyman, J., & Salajan, F. (2011). Lecture capture: Good student learning or good bedtime story? An interdisciplinary assessment of the use of podcasts in higher education. I EdMedia+ Innovate Learning (s. 3168–3178). Association for the Advancement of Computing in Education (AACE).
Leadbeater, W., Shuttleworth, T., Couperthwaite, J., & Nightingale, K. P. (2013). Evaluating the use and impact of lecture recording in undergraduates: Evidence for distinct
Lehmann, S., Skogen, J. C., Haug, E., Mæland, S., Fadnes, L. T., Sandal, G. M., Hysing, M., & Bjørknes, R. (2021). Perceived consequences and worries among youth in Norway during the COVID-19 pandemic lockdown. Scandinavian Journal of Public Health, 49(7), 755–765.
Lonn, S., & Teasley, S. D. (2009). Podcasting in higher education: What are the implications for teaching and learning? The Internet and Higher Education, 12(2), 88–92.
MacKay, J. R. (2019). Show and 'tool': How lecture recording transforms staff and student
Madsbu, J. P., Hole, Å. S., Myklebø, S., Syversen, T. L., Wedum, G., Hermanrud, I., Lervik, M. J., & Strand, M. (2021). Digital teaching and other digital interaction during covid-19, what has been learned, and what should be developed further? In the Scripture series. The University College in Innlandet.
Marchand, J.-P., Pearson, M. L., & Albon, S. P. (2014). Student and faculty member perspectives on lecture capture in pharmacy education. American journal of pharmaceutical education, 78(4), 74.
Morris, N. P., Swinnerton, B., & Coop, T. (2019). Lecture recordings to support learning: A contested space between students and teachers. Computers & Education, 140, 103604.
Maynor, L. M., Barrickman, A. L., Stamatakis, M. K., & Elliott, D. P. (2013). Student and faculty perceptions of lecture recording in a doctor of pharmacy curriculum. American journal of pharmaceutical education, 77(8).
Missildine, K., Fountain, R., Summers, L., & Gosselin, K. (2013). Flipping the classroom to improve student performance and satisfaction. Journal of Nursing Education, 52(10), 597–599.
Neuwirth, L. S., Jović, S., & Mukherji, B. R. (2021). Reimagining higher education during and post-COVID-19: Challenges and opportunities. Journal of Adult and Continuing Education, 27(2), 141–156.
Nordmann, E., & Mcgeorge, P. (2018). Lecture capture in higher education: time to learn from the learners. PsyArXiv. Advance online publication. https://doi.org/10.31234/osf.io/ux29v
O'Callaghan, F. V, Neumann, D. L., Jones, L., & Creed, P. A. (2017). The use of lecture recordings in higher education: A review of institutional, student, and lecturer issues. Education and Information Technologies, 22(1), 399–415.
Patton, M. Q. (2002). Qualitative research & evaluation methods (3rd ed.). Sage Publications.
Postholm, M. B. (2010). Qualitative method: an introduction with focus on phenomenology, ethnography and case studies (Translated from Norwegian: Kvalitativ metode : en innføring med fokus på fenomenologi, etnografi og kasusstudier) (2. utg.). Universitetsforl.
Reisetter, M., & Boris, G. (2004). What works. Quarterly Review of Distance Education, 5(4).
Skylar, A. A. (2009). A comparison of asynchronous online text-based lectures and synchronous interactive web conferencing lectures. Issues in Teacher education, 18(2), 69–84.
Schön, D. A. (1987). Educating the reflective practitioner: Toward a new design for teaching and learning in the professions. Jossey-Bass.
Säljö, R., & Moen, S. (2001). Learning in praxis: a socio cultural perspective (Translated from: Læring i praxis : et sociocultural perspective.) Lärande i praxis a sociocultural perspective Oslo: Cappelen academic.
Traphagan, T., Kucsera, J. V, & Kishi, K. (2010). Impact of class lecture webcasting on attendance and learning. Educational technology research and development, 58(1), 19–37.

Toppin, I. N. (2011). Video lecture capture (VLC) system: A comparison of student versus faculty perceptions. Education and Information Technologies, 16(4), 383–393.

Wagner, N., Hassanein, K., & Head, M. (2008). Who is responsible for e-learning success in higher education? A stakeholders' analysis. Journal of Educational Technology & Society, 11(3), 26–36.

Wertsch, J. V. (1991). Voices of the mind. Cambridge, MA: Harvard University Press.

Wertsch, J. V. (1998). Mind as action. Cambridge, MA: Harvard University Press.

Witton, G. (2017). The value of capture: Taking an alternative approach to using lecture capture technologies for increased impact on student learning and engagement. British Journal of Educational Technology, 48(4), 1010–1019.

Yoon, C., & Sneddon, J. (2011). Student perceptions of effective use of tablet PC recorded lectures in undergraduate mathematics courses. International Journal of Mathematical Education in Science and Technology, 42(4), 425–445.